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MATLAB:

Women, Children and Health

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COVER:
Each day's rounds for a Community Health Worker includes the challenge of negotiating bridges such as this one in Matlab.

(Cover design and photograh by Zahid Iqbal)

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Dedication

This book is dedicated to the Matlab field workers, and particularly the community health workers of the MCH-FP Project, who have walked from house to house, from village to village, every day of every year since the beginning of the project.

Their names are unknown to the world, but their work deserves to be known.

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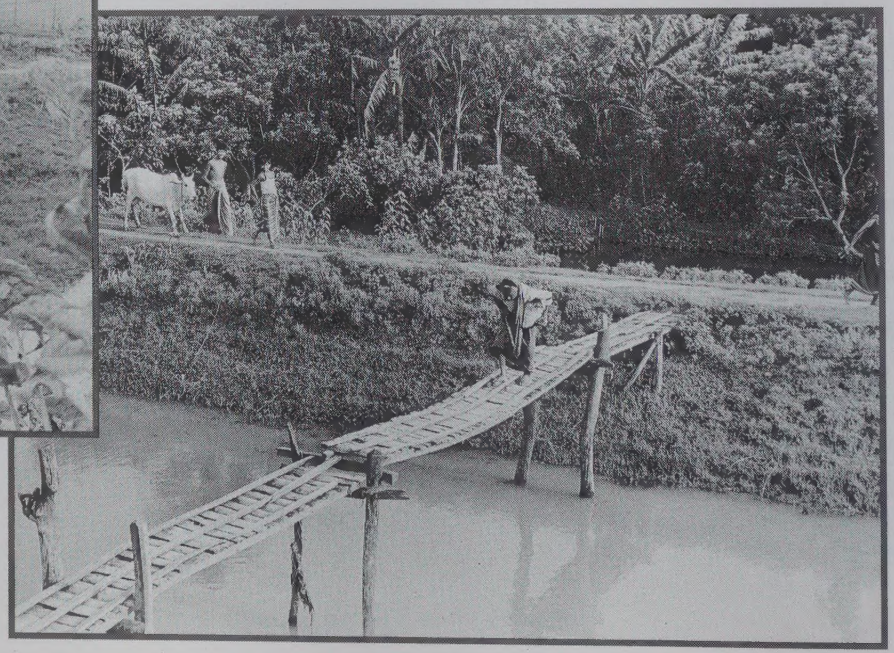
Dotting the Matlab countryside, these bamboo bridges are usually the only way to get from one spot to another.

They bridge baris, as shown on the cover and elsewhere in this book. To fall from one may be less embarrassing and painful as it might be from another, as is obvious from these pictures....



Acknowledgements...

It is impossible to name all the individuals who have contributed to the production of this book, either through their daily dedicated work such as the Matlab field workers and support staff, or through their scientific or administrative contributions. More than one hundred investigators have conducted studies related to maternal and child health or family planning in Matlab and published scientific papers based on data collected during these studies.

Special thanks however, are due to the successive ICDDR,B Directors, who have guided and supported the investigators and encouraged the project of this book. Professors Henry Mosley (1975-79), William "Bucky" Greenough (1979-1985), Roger Eeckels (1985-1989), and Demissie Habte (1989-today).

The realisation of this book was made possible by grants generously provided by institutions who have expressed their interest in promoting Matlab and the work done in Matlab.

- ☐ the Norwegian Agency for International Development (NORAD),
- ☐ the Ford Foundation,
- ☐ the Belgian Administration for Development Cooperation (BADC), and
- ☐ the World Health Organization (WHO)

The editor wishes to thank these institutions and their representatives: Elizabeth Eie and Randi Bendiksen for NORAD, Jose Barzelatto and James Ross for the Ford Foundation, Herman Van den Abeele, Jan Van Mullem and Vital Kellens for BADC, Geoffrey Walker and Angela Petros Barvazian for WHO.

In addition to authors and co-authors, other members of the ICDDR,B — both scientific and administrative — gave a lot of their time to review the chapters or to ensure the smooth progress of the project, in particular, the

team of the Centre's library and publications branch, led by Shamsul Islam Khan, played a crucial role in the publication of the book. The "historical" photographs, extracted from the Centre's picture library, were mostly taken by Asem Ansari and supplemented by the work of the photographers listed at the end of this book.

Several external people provided assistance in reviewing and/or editing parts of this book. Claire Escoffier Fauveau, Lynn Key, Josephine Sack, Graham Wright, and Geraldine Zwack. The last and very thorough scientific reviews were made by Drs. Bradley Sack, Associate Director, and K. Zaman, Senior Medical Officer, Matlab.

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The ultimate and decisive touch was ensured by Zahid Iqbal, the publishing consultant to whom we entrusted the design of the entire book and the piloting of the book through its various stages to the finished product.

Finally the editor wishes to thank ICDDR,B and the countries and agencies which share ICDDR,B's concern for the health problems of developing countries since 1975. The governments of Australia, Bangladesh, Belgium, Canada, China, Denmark, France, Japan, the Netherlands, Norway, Saudi Arabia, Sweden, Switzerland, the United Kingdom and the United States of America, the United Nations Development Programme, the United Nations Population Fund, the United Nations Children's Fund, and the World Health Organization, and private foundations including the Ford Foundation and the Sasakawa Foundation.

In keeping with the principles of an edited book, it must be emphasised that the views presented in the chapters of this book are those of the authors and not necessarily those of the International Centre for Diarrhoeal Disease Research, Bangladesh.

— Editor

Foreword

The setting for this book is a cluster of villages that comprise the once-obscure area in Bangladesh called Matlab — a name known today to scientists and researchers across the world for research that has been critical in developing and testing interventions against major health and population problems of developing countries.

Contained in these pages is a glimpse of the unmistakable contribution made, in these fields, by the International Centre for Diarrhoeal Disease Research, Bangladesh (ICDDR,B) — and its predecessor the Cholera Research Laboratory — during a span of more than three decades. Over a 33-year period ICDDR,B has developed into a unique and remarkable infrastructure of health and population research that has certainly enriched global programmes - or played a pivotal role in enhancing their effectiveness.

The jewel in this unique infrastructure is Matlab, once just a site to test injectable cholera vaccines and now the largest and longest sustained population laboratory in the developing world.

Research findings, such as those in this book, have been published in books and journals across the world and presented at international gatherings of scientists. As part of the ICDDR,B effort to disseminate its research findings to a global audience, an annotated bibliography of studies undertaken in Matlab was published in 1990, followed a year later by a more extensive list of publications from ICDDR,B for the period. Less readily available are the innumerable theses and dissertations of graduate and doctoral students from several countries who continue, in increasing numbers, to use Matlab as the basis of their research.

The story of Matlab is a tale of success — with credit due to the persons who initially had the vision to establish Matlab as a site to test and quantify health interventions. Special recognition should be accorded in this respect to the late Dr. A.K.M. Fahimuddin, who was instrumental in locating Matlab; of Dr. Abraham Benenson, the then director of the Pakistan-SEATO Cholera Research Laboratory; and Dr. Robert Oseasohn.

Clearly the greatest acknowledgement goes to the people of Matlab — the mothers, the children and the fathers who have always been supportive of the work being done in their community. Also to be credited are the numerous field workers, researchers and support staff who have dedicated their efforts towards giving new meaning to maternal and child health and to family planning — the areas of research summarized in this book.

Finally to be commended are all those who have, in one way or the other, contributed to this book — especially the editor and chief contributor, Dr. Vincent Fauveau, who headed the MCH-FP programme in Matlab for almost five years and, subsequently, undertook the challenging task of putting together this very vital part of the ICDDR,B story.

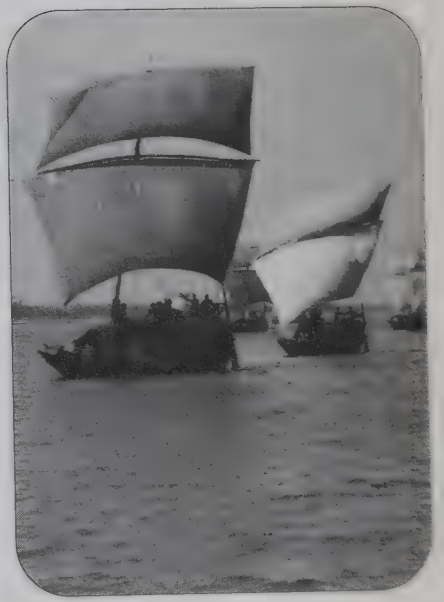
— Demissie Habte, M.D.,
Director

Sailing cargo boats loaded with rice harvests race down the Meghna near Matlab...

CHAPTER 1

Introduction

Vincent Fauveau



With a total population of 110 million in 1992, an annual population growth rate of 2.6 per cent, an infant mortality rate still over 100 per 1,000 live-births, a gross national product of US $130 per capita and an adult female literacy rate of 20 per cent, Bangladesh faces more difficulties than most other large countries of the world. In fact, despite some progress in agriculture and an infrastructure largely driven by international donor assistance, and regardless of health and population efforts, many socio-economic indicators, including social inequality, have tended to deteriorate.

One way to address this trend is to stabilise population growth, and the country's policy-makers have re-emphasised this in their Third Population Plan in 1985. Maternal and child health programmes and family planning interventions are both essential components of fertility control, and concerns have been expressed about the lack of integration between them in Bangladesh. Matlab focuses on this issue.

The name "MATLAB" does *not* stand for "MATernal and child health LABoratory"! Rather, it is the name of a once unknown marketplace in the middle of the Ganges-Meghna deltaic floodplain located between Dhaka and the coast of the gulf of Bengal. In Bengali, the language of Bengal, *matlab* means "intention", "plan", "idea".

The name became famous because of the establishment in the cholera-prone Matlab Bazaar of the field station of the Cholera Research Laboratory, back in 1963. The status of "The Lab" (as it was quickly nicknamed) changed in 1978, when it became the International Centre for Diarrhoeal Disease Research, Bangladesh (ICDDR,B), an independent, international, non-profit making organisation hosted and supported by the Government of Bangladesh.

Matlab has remained the principal field station of the ICDDR,B, offering opportunities for conducting a wide range of studies for scientists from the many successive scientific divisions of the Centre, currently named the Community Health, Population Science and Extension, Clinical Sciences, and Laboratory Sciences Divisions.

Few (if any) other rural areas of the developing world have been studied as intensively, as extensively, and for

Part I

as many years as Matlab. Few other field stations have witnessed the first trials and the training of so many scientists who are now holding key positions in the world of international health.

A list of the principal investigators who conducted studies in Matlab at some time between 1975 and 1990 is found at the end of the volume. In spite of many efforts to retrieve records of all these scientists, the list is probably still incomplete. It is followed by another list, also incomplete, of scientists who have analysed data originated from Matlab and published work based on these analyses.

The idea of writing a book about Matlab has been in the minds of many during the last ten years. The issue was often raised on the occasion of visits from the "ancients", the people who had initiated Matlab, who had spent so much of their time and energy organising the first studies, at a time when none of the transport facilities, modern computer equipment and office accessories existed.

As the thirtieth anniversary of the ICDDR,B and the twenty-fifth anniversary of the Demographic Surveillance System were approaching, everybody agreed that there was a need to put all the lessons of Matlab together under a single cover. But the challenge was considerable. Who would find the time and the funds to write such a book?

CONTINUED...

Introduction

The option of a collection of articles focusing on a common theme came as the only reasonable alternative. Thanks to the generosity of a few long-time donors, funds were finally raised, and someone volunteered to coordinate and edit the collection. Editing a book involving more than twenty contributors from all over the world requires energy and patience. The editor can claim a reasonable experience in Matlab and familiarity with the Matlab community, having himself visited the field station every week of every month during five years, from September 1985 till June 1990.

The objective of this book, therefore, is to report the history, achievements and main lessons of the successive Maternal and Child Health and Family Planning (MCH-FP) Programmes implemented in Matlab from 1975 till 1990.

MCH-FP is taken here in its broad sense, including all health and population issues dealing with mothers and children, the groups that are most sensitive to diseases and social problems in developing countries. This review starts in 1975 because that year marked the start of the Centre's involvement in family planning issues, with the beginning of the first scientific population trial ever implemented in Bangladesh, the Contraceptive Distribution Project. The mid-seventies also witnessed the first studies in the field of social sciences.

In spite of the historical attachment of Matlab with cholera and diarrhoeal diseases, the focus of this book is on maternal and child health and family planning. In fact the history of cholera research in Matlab is so fascinating that it has already justified the publication of a book (van Heyningen and Seal, 1983) and a doctoral thesis (Glass, 1984)

In Bangladesh, maybe more than in many other developing countries, *the current priority problem is* ***population pressure.*** A remarkable feature of the debate on health and development during the late seventies was the relative neglect of population issues. The child survival strategies issued at that time implied that infant and child mortality reduction would induce fertility reduction, even in the absence of dramatic socio-economic progress.

Alternative strategies originating from an opposite side claimed that population control should be given priority and would have

**Although the expression "Mother and Child Health" is often preferred to "Maternal and Child Health", we have maintained the latter throughout the book because it is the common usage in ICDDR,B*

an impact on mortality. The debate is not closed and each theory draws arguments from field experiments.

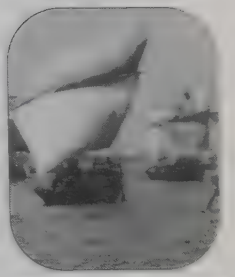
However, in contrast with most other longitudinal community studies, (Narangwal in India, Machakos in Kenya, among others) Matlab is one of the few places where family planning programmes were given pre-eminence over child survival interventions. It is, therefore, of utmost interest to review what has been learned in Matlab during this period.

Can Matlab be called a "success"? The question and the answer lie tacit in all chapters of this book, and are finally summarized in the concluding chapter. However, it must be made clear at this point that **Matlab is not and was never intended to be a "model" of primary health care or maternal and child health and family planning, designed for immediate replication in other parts of the world or even in other parts of Bangladesh.** If the word "model" has been frequently used (see Chapter 22), it was in the sense of "a small-scale pilot project, in which it was somewhat possible to influence input and quantify output", not in the sense of a perfect achievement ready to be copied elsewhere.

Rather, Matlab was intended to be a learning place: learning about the epidemiology of common diseases, learning about operations research, learning about programme implementation, learning about scientific methods.

Most of the lessons learned in Matlab about the epidemiology of maternal and child health can reasonably be extended to the major part of Bangladesh, but it is not the case for the "interventions" or operational approaches to deliver family planning, child survival and maternal health services. These interventions were primarily proposed with a view of testing their efficacy or impact on limited samples of population, and of learning from the problems of implementation in real life. Adaptations have to be made before replicating these interventions on a national scale.

The first part of this book is the presentation of the physical, human and research setting in Matlab. In Chapter 2 the specific geographical patterns of the area and their relationship to human settlement and behaviour are described. In Chapter 3, two of the most senior Matlab scientists present the history of research conducted in Matlab. In the following two chapters, Chapters 4 and 5, the main research design and the methods of data collection are described.



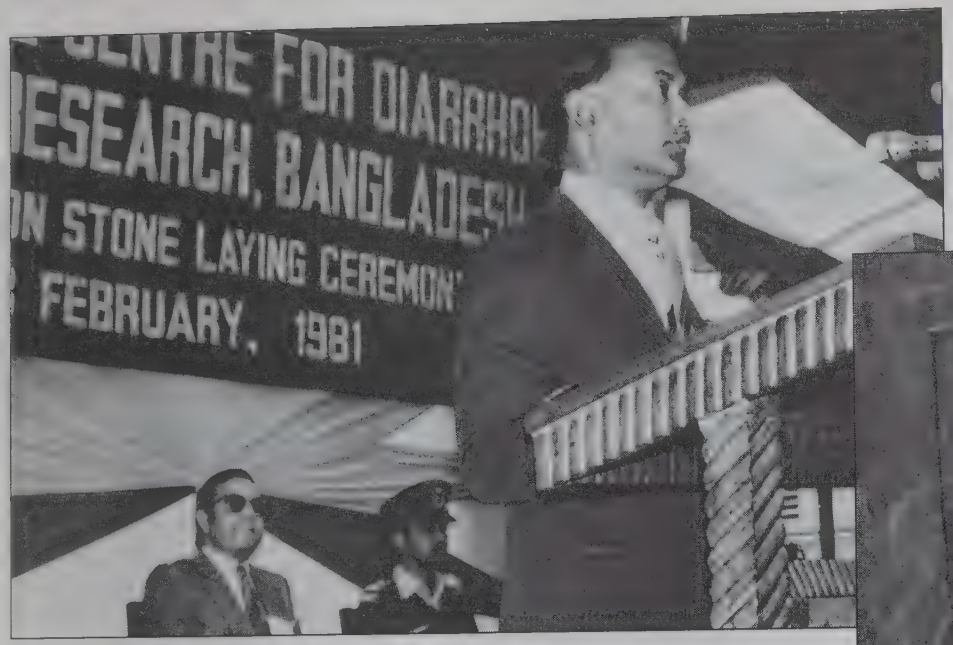
In addition to the Demographic Surveillance System, which is the key to all studies done in Matlab, the Record Keeping System of the intervention area, the special studies and the assessment of cause of death are described.

The second part of the book is devoted to the main findings of Matlab in specific fields within maternal and child health and family planning. These findings have been grouped under seven headings: family planning (Chapter 6), women's health (Chapter 7), perinatal health (Chapter 8), diarrhoeal diseases (Chapter 9), acute respiratory infections (Chapter 10), measles (Chapter 11), and nutrition (Chapter 12).

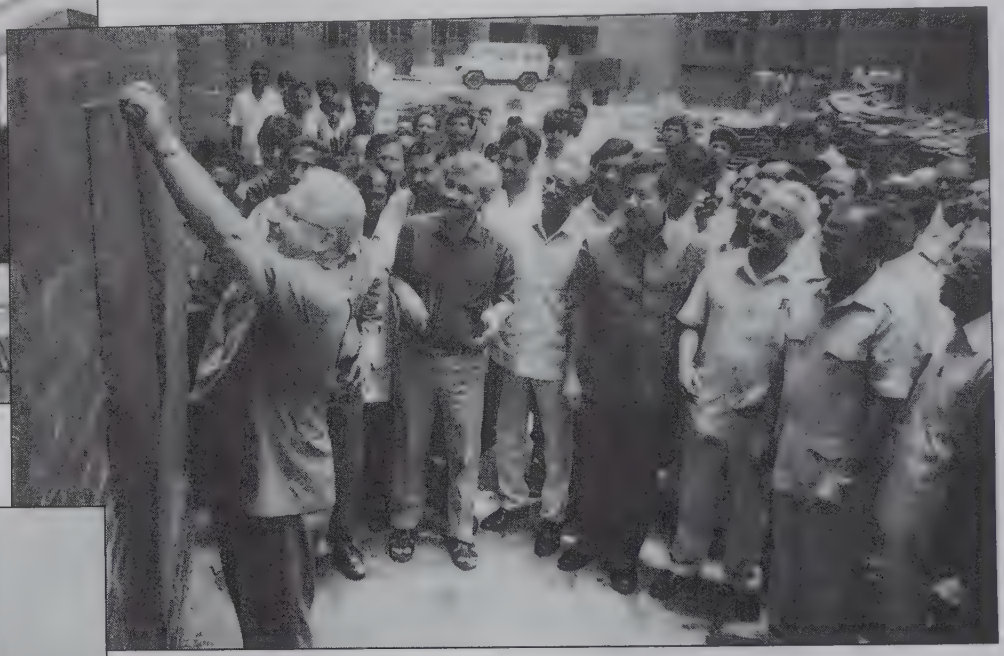
Because the experience of Matlab in some other important fields such as hygiene, environmental sanitation, and injuries, has been quite limited or restricted to a few surveys, these issues are not specifically reviewed in separate chapters.

In the third part of the book are addressed broader social, anthropologic and economic issues related to MCH-FP, such as: cultural perceptions of health issues (Chapter 13), perceptions of child health (Chapter 14), explanations for contraceptive use (Chapter 15), effect of parental gender preference on fertility and mortality (Chapter 16), changes in women's status in relation to the MCH-FP Programme (Chapter 17), perceptions of maternity care (Chapter 18), and socio-economic determinants of child morbidity and mortality (Chapter 19).

CONTINUED...
Introduction



The official ceremony for the stone laying of ICDDR,B's Hospital in Mohakhali (known as the Cholera Hospital in the whole country). The late President Ziaur Rahman delivers his speech, Mr Bashir sits in the background. the hospital has now been extended with the addition of a second floor.



Official inauguration of the new Matlab ICDDR,B Hospital in June 1990 by Charles Henri Larsimont, Resident Representative, UNDP in Bangladesh.

View of the Matlab ICDDR,B Station, located until 1990 within the premises of the Upazila Health Complex.

The cost of the health activities implemented in Matlab, sometimes judged disproportionately high, is the cumulative cost of epidemiological surveys, implementation of interventions, operational research and evaluation studies. The replication of such costly operations in the rest of the country is out of the question. Moreover, it is extremely difficult to isolate the cost of services from the cost of research. These issues and other health economic issues are developed in Chapters 20 and 21. The methodologies that were tried in Matlab to address cost-effectiveness issues are presented, as well as some tentative results. Because the methods are difficult, and based on many assumptions, the findings must be considered with caution.

In the concluding chapters of Part IV are discussed the relationships between Matlab and the government's Maternal and Child Health and Family Planning programmes, the experimental translation of some of the components of the Matlab project in the National Family Planning and Health Programme (Chapter 22), and a few concluding remarks (Chapter 23).

In finishing the introduction, and before letting the reader wander through the chapters, the editor would like to express two wishes:

The first wish is that this book will trigger the desire to read further about Matlab, among those not familiar with Matlab and among those not familiar with scientific fields other than their own. In both cases readers are encouraged to look for the many original papers published elsewhere, either through the ICDDR,B Library Services, or through other bibliographic search systems.

These thousand original papers, most of them referenced in the chapters of this book, represent the real substance of the research carried out in Matlab.

The second wish is that the reading of this book by either junior or experienced researchers, from institutions involved either in the biomedical or the social sciences, will trigger their desire to come to Matlab, to participate in the activities, to develop research protocols, and to add their own contribution to the wealth of Matlab.

■

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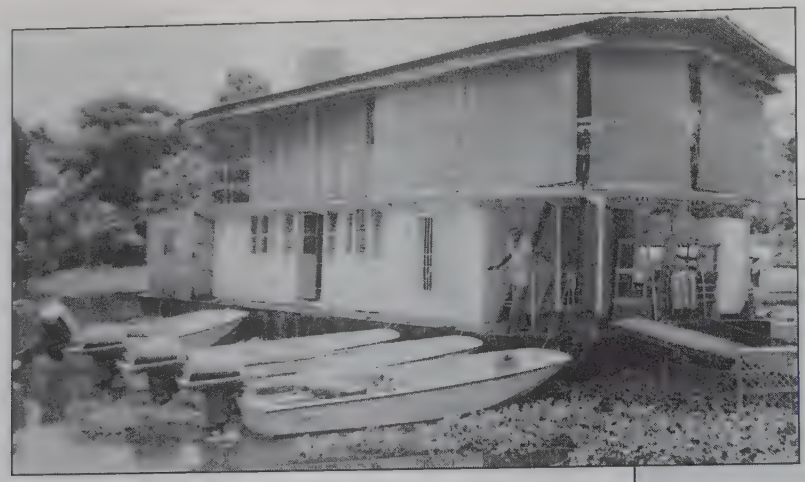


A classical view of the barge and the Matlab Upazila Health Complex in which the ICDDR,B was hosted up to 1990. The antenna was used for short-wave radio communication with Dhaka during the cholera vaccine trials. The famous barge (inset), which served as a hostel and a canteen for investigators and staff, a meeting room for visitors, a mechanical workshop for the speedboats, and a floating pier. Formerly it was a floating police station, and included a jail.

View of the recently completed Matlab ICDDR,B Hospital across the canal, with its drawbridge.

CHAPTER 2

Matlab: Physical Setting and Cultural Background

K.M.A. Aziz

Part I

The Cholera Research Laboratory (CRL) was established in Dhaka, Bangladesh, in 1960 to develop, improve and demonstrate measures for the prevention and eventual eradication of cholera. An essential component of this programme was the implementation of controlled field trials of cholera vaccines.

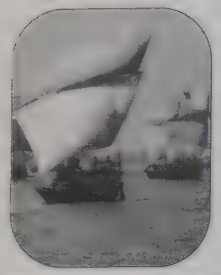
Villages in the Matlab *thana* (subdistrict) and its vicinity in the Comilla district (now Chandpur district) were selected for relevant studies. The field trials began in 1963 and initially covered 23 villages with a total population of 28,000 individuals. Over a period of ten years 210 villages were added and by 1974 the total population in 233 villages was found to be 263,000 which constituted the study population of the research under reference in this chapter (Aziz, 1979).

The findings presented here are based partly on empirical data collected by the CRL field workers under the overall study design and field guidance of the author. Frequent home visits by the author for over a decade helped him to get to know the people and the study area well. In addition to the empirical data referred to above, much of the information presented in this study was gained through personal observation by the author and from periodic censuses conducted by the ICDDR,B.

1. PHYSICAL AND HUMAN SETTING

Matlab is located in a regularly flooded area of Bangladesh, intersected by a network of tidal rivers, streams and channels and branches of two of the world's mightiest rivers, the Padma and the Meghna. The climate is subtropical and the Tropic of Cancer passes through the area. There are traditionally six seasons in the Bengali year. These are summer (March-May), the rainy season or monsoon (May-July), autumn (July-September), late autumn (September-November), winter (November-January) and spring (January-March).

Summer and winter are the two most popular seasons, which bring married daughters back to their paternal homes to enjoy mangoes and rice cakes. Though Bangladeshis identify six seasons, climatologically there are three prominent periods . These are the monsoon period, July-September, with an average rainfall of 152 cm.



or 60 inches (temperature range: 23°- 38°C); the dry winter season, October-February (temperature range: 13°- 29°C); and the hot dry period, March-June (temperature range: 26°- 38°C).

According to the CRL census of 1974 and the ICDDR,B census of 1993, about 84 and 88 per cent of the people, respectively, are Muslims. Almost all the rest are Hindus. Within this population, life expectancy at birth in 1966 and 1989 were found to be 52 and 62, respectively.

The language spoken in Matlab is a dialect of Bengali in which many Perso-Arabic elements are found. In the study population 41.5 per cent of males and 18.5 per cent of females claimed to be literate in 1974.

However, through a practical test measuring ability in simple reading and writing, 38.3 per cent of the males and 17.2 per cent of the females aged five years and over were actually found to be literate.

The primary occupations in the Matlab area are agriculture and fishing. Fishing is traditionally and primarily a Hindu occupation. Agriculture, fishing and other means of earning have not been technologically advanced. The same methods have been in use for centuries.

The common crops are rice, millet, jute, pulses, oil seeds, potatoes, sweet potatoes, wheat, onions, chillies, turmeric and other spices. Most of the cultivable land is given over to rice, the dietary staple. Only well-to-do agriculturists grow a small quantity of jute as a cash crop.

Annually, the water level varies by more than 4 meters from a high water peak in the monsoon season (July-August) to the low water level in the winter (January-March).

At peak water level almost all the agricultural land goes under water, most of the villages and hamlets become crowded clusters of islands, and travel is accomplished mostly by country boat. In the monsoon season it is difficult to find a location of ground raised enough for burial of the dead.

Villages have an average population of 1,100 persons, and the average population density exceeds 1,500 per square mile.

This figure is based on the total amount of residential, arable, and waste land. If only residential land is considered, the density increases manifold. During the monsoon, since most of the land is under water, the actual population density increases.

The population density here is one of the highest in the world (Glasse, 1965) and there has been rapid population growth in the study area between 1966 and 1975.

But the trend of growth has declined substantially following Maternal and Child Health and Family Planning(MCH-FP) interventions introduced in 1978.

Typical dwellings have two to four slanting roofs made of corrugated iron or thatched with straw. The walls are made of interlaced bamboo or jute-stick matting, or, in some cases, of tin sheets. Every house has a hard mud floor.

With the exception of a seven-mile motorable road connecting the Matlab Bazaar with the district capital Chandpur, there are no other paved roads in the entire study area.

During the monsoon, when most footpaths are submerged by water, internal communication and transportation is done mainly by country boat. At other times of the year, people travel mainly on foot. A dozen or so motorized passenger launches provide transport between distant villages and Matlab, or between Matlab and Dhaka or other large cities.

2. CULTURAL BACKGROUND: Muslims and Hindus

The Muslim settlement in Bengal originated with the conquest of

CONTINUED...

Matlab: Setting and Background

this country by the great Turkish General Ikhtiyar Al-Din Muhammad bin Bakhtiar Khalji in 1201 A.D. (Rahim, 1963).

There were possibly some Arab settlements in the Chittagong coastal area prior to that. In the ninth or tenth century A.D. seafaring Arab traders were known to have been in that region. But after the Muslim conquest, Muslim teachers and preachers and Sufi saints followed the soldiers into Bengal to begin their missionary work (Rahim, 1963). In the first regular census of 1872 in British India it was observed that Muslims formed the majority population in Bengal. There was an increase of the Bengali Muslims during the period of the British rule in the Comilla district.

Writing in the District Gazetteer of Tippera (subsequently Comilla) J.E. Webster noted:

"*The Muhammadans, allowing widows to remarry and on the whole more robust than their Hindu fellows, tend to multiply faster as will be apparent from an examination of the census figures. The Hindus, who in 1872 formed 35.2 per cent of the population, decreased to 31.2 per cent in 1891, and to 29 per cent ten years later. In 1901 the census showed 70.5 per cent of the population to be Muhammadans, all Hanafis of the Sunni sect; 29 per cent were Hindus , mostly Vaisnavs*" (Webster, 1910).

J.A. Vas, quoting the Census Report of 1910, said:

"*The Mohammedan population is growing at a relatively much greater rate than the Hindus. This is not due to conversions, of which very few are recorded. The greater fecundity of the Mohammedans is explained by the prevalence of polygamy and widow remarriage, the lesser inequality between the ages of husband and wife, the greater nutritiousness of diet and their greater material prosperity*" (Vas, 1910).

Apparently, a high birth rate was the single most important factor for the growth of the Muslim population of Bengal in the British period. All available evidence indicates that Muslim birth rates are still higher than Hindu.

This may result primarily from higher fertility among Muslim women, not from polygamy. The childbearing period of Muslim women is, on average, longer than that of the Hindus. Additionally, Muslim widows remarry and continue to bear children, while widow remarriage among Hindus is uncommon.

In the study area the Muslim lineages and homesteads commonly have titles or names. The origins of these are quite diverse. Lineage titles denoting high status often function as patronymics whereas other titles do not. In this sense they contradict the more usual situation, which corresponds to the hadiths or sayings of the Prophet Muhammad often cited in support of Islamic egalitarianism. Frequently Saiyad, Sheikh, Pathan and Mughal are referred to as the four high status groups at the head of stratified Muslim communities.

With the exception of some 2,000 Pathans and as many Saiyads, nearly all the Muhammadans of Comilla district called themselves Sheikh (Webster, 1910). The Saiyads claim direct descent from the Prophet Muhammad. The Sheikhs derived their status from real or imaginary descent from groups of foreign origin. Despite the reported historical presence of a variety of Muslim castes in the Matlab area, such caste groupings have not been found during the research, with the exception of a few Muslim quasi-caste groups.

The caste system recognizes a large number of groups of different ranks. It is a hierarchy of endogamous groups that individuals enter only by birth. For a Hindu, domestic ceremonies and customs, his home and temple worship, his circle of friends and relatives, and his occupation are determined by the level of the group into which he was born. The families of a particular caste often have a common name.

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Matlab: Setting and Background

In the study area the Brahmans and Kayasthas are few. The majority of the Hindus are Namasudras and Kaibarttas, who are the followers of Vishnu or Krishna. Though the Brahmans and Kayasthas basically belong to the sect of Saktas, they occasionally follow the Vaisnavic customs.

The following statement indicates the predominance of Vaisnavic people in the Comilla district: "In 1901 the census showed that 29 per cent of the population of Comilla district were Hindus, mostly Vaisnavs. The Namasudras and Kaibarttas were all followers of Vishnu and only a few Saktas are to be found among the higher castes" (Webster, 1910).

The forms of religion prevalent in Bangladesh during the pre-Muslim period were of two types: animism, as practised by the tribal peoples, and Hinduism.

Buddhism was, to a great extent, an extension of Hinduism or Brahmanism with certain modifications. Brahmanic doctrine was very much present in Hinduism. The tribal people, although converted to either Hinduism or Buddhism, did not practise rigid forms of their adopted religions.

Hinduism in Bangladesh has incorporated many pre-existing elements such as nature worship and worship of the dead. Rivers and streams are generally considered sacred. In conducting a religious service, the Hindus are required to go many times to the water points of rivers or canals. The *tulsi* plant (basil) and a few other plants are objects of worship.

In general, the Muslims and Hindus in the Matlab area live side by side, although there are villages which are almost exclusively either Hindu or Muslim. In traditional culture, there are many aspects common to both groups. "In the interior villages people of both communities live side by side, and so the relation between them is indeed an important factor in rural life" (Mukherjee, 1971).

"During the Muslim rule the Hindus began to put on shoes, and jamas which is a type of shirt. The Hindus gradually learnt to adopt the Persian menu like *pilau*, *korma*, and *kofta*. Under the influence of Islam the rigours of untouchability were mitigated, and there also arose a religious reformer like Chaitanya. The Hindus still bear as a mark of honour the surnames given to them by the Muslim rulers such as Sarkar, Mallik (Arabic *Malik*, master), Majumdar, Tarafdar, Shaha (Persian *Shah*, King)" (Shahidullah, 1963).

The Muslims, particularly the cultivators and labouring class, put on a *lungi* (a cloth like a skirt), a *nima* (a small half shirt) and a cap. The Muslim women wear a *saree*. *Payjam*a (loose cotton trouser), shirt (long or short), and *tupi* (cap) form the dress of the well-to-do Muslim males and the religious teachers, such as the *mullahs* and *maulvis*.

The *dhuti* is the common dress of the Hindu males. The women of Hindu well-to-do families generally put on a *kanchuli* (tight-breast) and an *orna* (scarf). They adorn themselves with various ornaments, such as necklaces, bracelets, bangles, earrings, and nose-rings. The use of vermilion marks and conch-shell bangles is common in all classes of women.

In Bengal until around 1940, a good number of Muslims also used to wear the *dhuti*. The Muslims adopted this Hindu cultural symbol, particularly related to the middle class, in an effort to get accepted at the same social level.

Following the death, in 1925, of C.R. Das, the noted nationalist leader of Bengal, there were communal riots and demands for a separate homeland for Muslims, following which the *dhuti* gradually became common dress for Hindus, and payjama and the *lungi* became the common dress for Muslims.

Since the partition of Bengal in 1947 the Hindus of East Pakistan started imitating Muslim dress, discontinued the use of the *dhuti* and started wearing payjama and the *lungi*. However, since the

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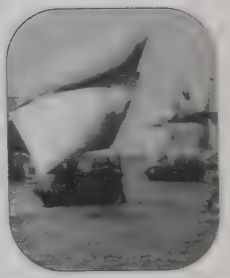

birth of Bangladesh in 1971, some Bangladeshi Hindus have been seen wearing the *dhuti* again.

A Muslim will never use the Hindu terms *Iswar* or *Bhagawan* in addressing God, but he does not hesitate to use the Persian word *Khoda* as the equivalent of *Allah*. Similarly, a Hindu usually does not use the Arabic word *Assalamu-alaikum* for greetings but he happily uses the Persian word *Adab* for the same purpose when he meets a Muslim. The Muslim also reciprocates in the same way.

The Hindus avoid the expression *Assalamu-alaikum* because it is specifically used by Muslims and recommended by Islamic teachers. *Adab* is a Persian word which means salutation. It is believed that this word did not come from any religious source and as a result it is acceptable to both Muslims and Hindus.

The Muslims in the Matlab area are greatly dependent upon the Hindu service castes. There are relatively few Muslim service people since the Hindu castes have long been fulfilling this role. As a result, there are almost no Muslim barbers, washermen, milkmen, goldsmiths or blacksmiths There are, however, some Muslim fishermen in the area.

Observations of Matlab indicate a separation of Muslim gypsy and *badyakar* (drum-beater) people from the rest of the Muslim social system and cultural framework. These two groups of Muslims maintain a great deal of autonomy, like the lower Hindu caste members. These boat-dwelling gypsies and the *badyakar* claim to have embraced Islam but they are casual in its observances. Like Hindu caste members, the gypsies eat and intermarry only with other gypsies. *Badyakars* marry within their own group but they try to dine socially with other Muslims and have no reservations about allowing other Muslims and Hindus into their homes.

Cultural Differences

The *Azan*, which is a public call for Muslim prayer five times a day, constantly reminds Hindus of the existence of an alien faith. Shown overleaf are some of the salient features of social customs indicating the difference between Muslims and Hindus. Members of both religious groups unanimously agree about such differences.

Taking this cultural background into account, it is natural that Muslims and Hindus often find it convenient to live with their respective fellow co-religionists in contiguous residential areas.

3. SOCIAL GROUPINGS WITHIN VILLAGES

People in a typical village in the Matlab area are internally segmented into different groups, such as the *ghar*, or the *bari*. Definition of these terms can help to provide an understanding of village social structure.

The *ghar* or household literally means the housing unit which accommodates all the members of a particular family. Each household unit is called a *cula* which means "hearth group" or *khana* which means eating unit. The *ghar* membership is mainly based upon patri-virilocal residence. It is the primary unit of production and consumption. The *ghar* is an area of interpersonal relations.

In his study on the Pandits of rural Kashmir, T.N. Madan made the following observations:

"A villager's attachment to his house is great. He is born and brought up in it, and here he gets shelter, food and emotional security. It is again here that he receives and entertains his kith; performs various rituals and ceremonies; keeps his belongings; and when the end comes, it is here he wants to die. To an individual ghar is symbolic of the purpose of his existence and strivings. All the major events in his life and in the lives of his co-resident relatives (births, marriages, partitions and deaths) take place in this home. He devotes his life to make a contribution, in one capacity or another, to the upkeep of the ghar (house and household) to which he belongs. The sentiments of love, sharing and solidarity that characterize inter-kin relations in a well-integrated household, are in the individual's estimation, the highest ideals of human conduct" (Madan, 1965).

CONTINUED

SOCIAL CUSTOMS

MUSLIM	HINDU
Muslims eat beef but do not eat pork or turtle meat. Muslims also do not sever the head of a sacrificial animal from its body.	Do not eat beef, since the cow is considered a goddess. Pork is eaten by certain castes. Turtle meat is commonly eaten. Hindus separate the head of a sacrificial animal from its body.
May wash hands on the eating plate after finishing a meal.	Do not wash hands on the eating plate after finishing a meal.
May not defaecate or urinate in an east-west (i.e. toward Mecca) sitting position.	May defaecate or urinate in an east-west sitting position.
Circumcise male children.	Do not circumcise male children.
Wear a "tupi" cap at the time of prayer. (Most elderly males wear it as an ordinary part of dress).	Do not ordinarily wear a cap at any age or on any occasion .
Are encouraged to wear a beard.	Are not encouraged to wear a beard.
Do not sleep or lie in bed with their feet facing West (toward Mecca).	Do not sleep or lie in bed with their feet facing East because gods and goddesses stay in the East).
Need not change cloth used overnight by married men and women.	Must change cloth used overnight by married men and women.
Prohibit music and drum beating in the mosque compound.	Allow bell-ringing and conch-shell blowing as part of the religious ceremony inside the temple. (Music and drum beating are common in order to gain the blessings of gods and goddesses) .
Do not spread cow-dung mixed with water in a room or courtyard.	Spread cow-dung mixed with water over the floor of each room and the entire courtyard each morning.
May do anything on their birthdays .	May not fix the date of their marriage or cut hair or nails on their birthday.
Women are encouraged by religious leaders to observe seclusion from strangers.	Women are not obliged to observe seclusion from strangers.
Choose most names from the Arabic and Persian languages.	Choose most names from the Sanskrit and Bengali languages.
Greet each other by raising the right hand.	Greet each other with palms folded together.
Prefer the use of Perso-Arabic words.	Prefer the use of Sanskritised Bengali words.
Do not prefer to die outside the dwelling house.	Prefer to die outside the house near a tulsi (basil) plant, which is regarded as a sacrament of the presence of God Vishnu.
Bury their dead.	Burn their dead, except children ten years of age or younger who are either buried or dropped into water.
Believe that the house of God is to the West.	Believe that gods and goddesses live in the east.
Contract marriages and formally divorce.	Enter into marriage as a sacrament and do not formally divorce.
May change a marriage date and time.	Do not change the time of a marriage once it is fixed by a priest except under certain specific circumstances.
Never seek financial assistance from a Hindu for a religious purpose.	May seek financial assistance from a Muslim for a religious purpose.

The functional aspects of the *ghar* in the Matlab area have great similarities with those existing in the Pandit society of Kashmir. The *ghar* rarely consists of more than 15 people.

Familial in character, the *ghar* normally includes consanguineal kin members and their married partners, and has individuals of one to three generations. In addition to consanguineal members, the *ghar* may include other kin or affines.

Bari literally means a "homestead," but commonly refers to a group of households sharing the same courtyard. If the relationship between the heads of households within a *bari* is determined, then the relationship between the households themselves can be understood from the point of view of kinship.

There is no recognized *bari* head for practical purposes. But the senior male and female members of the *bari* are accorded special respect because of their specific position in the family tree. Each *bari* or homestead may contain one or more joint or nuclear families.

A nuclear family consists of a man, his wife and their unmarried children; they usually live in one house and always have a common hearth. An extended family consists of several nuclear families united by parental or sibling ties; typically it consists of a father, several of his married and unmarried sons, and their wives and children.

If the extended family is a joint family, they cook at a common hearth, store grain in a common granary, usually accept the leadership of the male with highest management capacity and hold rights as co-parcener in a common estate. The distinguishing feature of a joint family compared with an extended one is the co-ownership of property or estate.

In the study area, according to the 1968 census, in 101 villages there were 19,433 hearth units. After 6 years (in 1974) there was a new census conducted in the same villages which revealed that the total number of hearth units had risen to 21,772. This is a total increase of 12 per cent or an annual increase of about 2 per cent.

In the sample populations under study, 722 out of 2,319 domestic units had agriculture as their primary means of subsistence. Statistics show that, in agricultural families, providing an adequate means of support is an increasingly difficult task. With the annual rise in hearth units comes a steadily increasing need for more land for housing and crops.

Already most of the people in the area have less than 50 square feet of living space per person. The cost of housing materials and land is continually rising. Approximately 30 per cent of the simple nuclear agricultural families are landless, and are being compelled to seek employment, other than agriculture, usually on a daily wage basis.

Since economic life is primarily organized around household units, a certain amount of cooperation is necessary between the groups of households or *baris* to overcome bottlenecks in agricultural operation. Consequently, households depend upon one another for loans of food grain, cash, exchange of labour, sharing of a common courtyard for processing harvested agricultural products, sharing of agricultural implements and bullocks, and sharing of utensils.

Certain inherited paternal property is kept separate for common use, with the objective of gaining the maximum benefit from it. Among the commonly shared resources are the pond, the parlour, the country boat, the pathways within the *bari* compound and, in the case of Muslims, the graveyard.

When inter-household support is not forthcoming, it is then sought from alternative sources beyond the *bari*, the immediate neighbourhood or even the village. However, for security purposes, inter-household cooperation among the members of the *bari* is essential.

Every household is run under separate economic management based on the earnings of the household members. This can be

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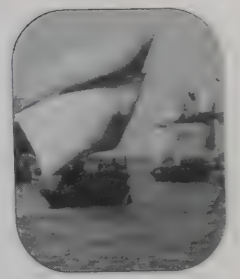
◀ *A street in the market in Matlab Bazaar. Both sellers and buyers are male and, occasionally, children and elderly women.*

▲ *Each bari has a pond where women can get water for domestic and personal purposes. The water level can become quite low during the dry season.*

◀ *Country boats are the only means of transportation during the rainy season in most of the Matlab area, even when water hyacinths clog canals and rivers.*



termed a primarily independent economic unit. In spite of this independent economic management there is a continuity between the households. The economy has tied the members of the majority of the households in the area to an agricultural economy.

The majority of the households in the study area are small and simple: Forty-four per cent of the total households in the study area are simple nuclear families. However, it is found that a considerable number of families in the study area have intricate and elaborate family situations.

4. SOCIAL RELATIONS WITHIN THE FAMILY

The patrilineal and virilocal elementary or joint family is the normal type of family unit found within the study villages. When a son-in-law settles with his wife's parents, it is an example of uxorilocal residence. But this is rare and is largely confined to the cases of a few orphans and children of very poor parents, who have to take recourse to marrying a particular girl in order to live with the parents-in-law.

It is common for sons to separate from their parents within a few years of their marriage. As a result of this separation they start as an elementary family, which at first usually comprises only the husband and wife. This elementary family gradually becomes larger as children are added to it.

When sons grow up, get married and continue to live with their wives in the parental home with co-owned property, the unit can be classified as a joint family. Effective married life begins almost immediately after the marriage ceremony or, in a few cases, within six months at the most.

For a year or so after marriage a son continues to live with his parents. His wife also lives with him. Domestic quarrels and dissensions develop within this period and compel him to start thinking about separation from the family. In some cases this takes place in the course of the following year; in others it may take several years until a few children are born or the number of dependents grows. Those extended families who can keep themselves together for about five years are generally able to live under the same roof without any discord for quite a long period. However, separation from the family is known to have taken place, in some cases, even after ten to twelve years of living together.

Within the family unit, the eldest male is generally regarded as the head. His wife or the next senior male is given the second place. A respectful son often describes his old widowed mother as the "head" of the family. However, in many cases the *de facto* head of the family may be a son under whose guidance and supervision the land is cultivated or the craft or profession of the family is practised.

Parents dominate the scene in their youth and middle age. With approaching old age, when they become ineffective in the management of the household economy, including property, they gradually retire from such activities.

Nominally, they remain the head of the family, but their sons have delegated power and authority to conduct the management of the property and the profession as they like.

As long as the father remains the real head of the family, the mother is given responsibility for domestic management. Sons are expected to obey her and the daughters-in-law are expected to perform household duties according to her guidance. Any inability or reluctance on the part of a daughter-in-law to carry out the instructions of her mother-in-law frequently leads to an exchange of verbal abuse.

Between sons and daughters, as a rule, preference is shown to the former, but if the sisters have considerable seniority in age, their younger brothers are expected to respect and obey them.

The preponderance of two-generation households over three-generation households is greatest among the poor families. The

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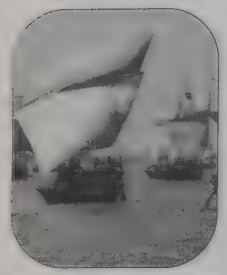

decline in the number of generations has weakened the family both as an economic unit and as a social unit.

Traditional tensions growing out of competition between brothers over the inheritance of paternal property affect the relations between numerous households in the villages.

In Matlab, according to the CRL census of 1974, the average family size was 5.87 persons — which was identical for both Muslims and Hindus. About 30 per cent of the population lived in small families (< 4 members).

About 89 per cent of households were headed by males and about 11 per cent of households were headed by females. Single person households were usually headed by widows. By 1982, the family size had changed very little but the female-headed families increased to 13.2 per cent — an increase of 2.2 per cent.

Changes occur in the size and composition of nuclear families. An incipient nuclear family commences as a legal union of husband and wife in marriage. This union is devoted to the procreation of legitimate children, their care during infancy, their socialisation, and their material support until the children are sexually mature.

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Matlab: Setting and Background

This unequivocal process of expansion comes to an end when the first child, particularly the first male child, marries and reproduces, setting up a similar incipient nuclear family. From now on, the original family is in a state of dissolution.

This may be concealed, however, by the birth of further children especially when the full reproductive span of spouses, particularly the male spouse, is utilised in polygamous unions. Complete dissolution occurs when all their offspring have married, excluding the eventuality of death or divorce of spouses.

The formal development of the simple nuclear family begins, by definition, when children are born to the spouses. This is one of the crucial stages in the formation of a domestic unit based upon the family. Among both agricultural and fishing people, the birth of a male first child is considered a sign of good luck because, eventually, it is the male child who will assume the responsibility of taking care of the family property.

As the family grows, its members will perform the everyday activities after the division of the homestead into its male and female sections, known as outer house or *bahir bari* and inner house or *bhitar bari*.

The subsequent development of the nuclear family is, in effect, the marital history of the male household head and his wife or wives. Normally, sons and daughters are added to the simple family consisting of a man with only one wife. In rare cases it may be expanded by the addition of other wives and their children. Further, children may be added to these husband-wife components.

Divorce may take place, but normally the children born to a man stay with him, or are claimed by him when they are at the age of seven to ten. All these developments are crucial in consideration of the viability of the simple or compound family household.

When the married sons have demonstrated their own powers of procreation, their allocations of property may be turned over to them for the formation of their homesteads and households. The sons have now become husbands and fathers. While these developments have been taking place, the father's personal power, occupational skills and fertility have been diminishing.

Although serial monogamy and the children resulting from new unions may temporarily conceal the fact, he is steadily losing dependents as they get married. The parents frequently prefer to live with the last unmarried son.

Sooner or later after the death of a father, a complete distribution of property occurs among both Muslims and Hindus. Among

Muslims when an extended family divides, the commonly held agricultural property is distributed among its members mainly according to religious prescription.

According to the traditional custom among Muslims, the main living room of the parents usually goes to the youngest son at the time of the distribution of property among the children. In the case of Hindus, the commonly held property is distributed according to the traditionally followed rules. When an extended family is split following the father's death, his main living house usually goes to his wife, or in her absence, to his eldest son.

Though the grandfathers and uncles may live in separate *ghars* and own separate estates, and their wives may cook separately, the children of the *bari* are not wholly psychologically dependent on their own parents.

A child is generally cuddled by the mother and father, and sometimes by younger uncles as a demonstration of affection. If a child is lucky enough to have a grandfather or grandmother, he or she will also be cuddled by them. Sometimes grandparents may make a show of cuddling in the presence of their son to please him, so that they might receive favourable care in their old age.

The girls, after attaining the age of 11 or 12 years, stay mostly in the company of women and children within the bari. At this stage, particularly in well-to-do families, they are relieved of duties outside the *bari*. They will start wearing cloth covering the legs down to the ankle. They are strictly advised to shun the company of male play-mates.

After marriage the young man may now and then see his wife working side by side with other young brides in the courtyard of the *bhitar bari* or inner house.

When the wife is young and has not yet produced a child, her husband can speak to her only occasionally when in the presence of others. When she becomes the mother of a few children the husband may speak to her more often, but even then direct address to her is forbidden by convention. In no case is the young wife allowed to talk to strangers.

Usually there is no assignment of duty outside the *bari* courtyard until the young wife becomes the mother of a few children. The services of children are frequently used by both husband and wife to pass on messages between themselves when either of them is not available on the spot or when there is a senior person present. The senior person referred to here may include the father, mother, father's brother, father's brother's wife, elder brother and so forth.

5. DYADIC RELATIONS IN THE FAMILY

In Matlab society the relationship between any two family members is more strictly prescribed than in many societies. This pattern of relationships is the core of the larger kinship network and gender-role expectations.

The contrast between joking and avoidance relationships is found in many societies in the world, and there have been many comparative studies of this phenomenon in anthropology. With whom one has a joking or avoidance relationship depends on the specific kinship system, but this is always related to sexual matters.

The dyadic role expectations are more pronounced in Matlab society than in many others because of the extreme gender-role expectations in this society, which have ramifications in the whole constellation of inter-personal contacts within the family as well as outside.

When a male past puberty communicates with a female past puberty who is neither a consanguineal nor affinal relation, he usually addresses her by using the kin term appropriate for mother or sister. This is to discourage thoughts of possible sexual relationships.

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This is but one example of the wide network of fictive kin a person can build up within his village and outside it (Aziz, 1979). By this mechanism any individual can place all other individuals of the opposite sex in an appropriate category, being either marriageable or non-marriageable.

Writing on Muslim women in India, Bhatty (1976) noted:

"*Even inside the house she is not supposed to mix with men other than her brothers, father and grandfather. The age at which this seclusion is imposed varies from community to community, but it starts even at six and rarely above twelve. This practice is deemed necessary because woman is conceived of as a sex object, who inevitably arouses, by mere appearance, sensual desires in men over which they are not expected to have any self-control.*"

In the study area, on the attainment of puberty the movement of girls outside the homestead without the company of any immediate family members ceases.

Husband-Wife Relations

Respondents in the study area were quick to vocalize the duty of a wife to obey her husband. This is balanced by the duty of a husband to support his wife. Ideals of female behaviour are so symbolically important for the family that they are often a matter of discussion.

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The marital union of two partners depends wholly on the favourable opinion of the influential members of the village or *samaj* (social group) territory of the boy and girl concerned. To enhance the prestige of a man in the village it is required for him to have a network of powerful affinal relatives. Commonly, there is a continuous desire and effort on the part of a kinsman to raise the position of his lineage (*bangsa*) members. One of the usual ways of gaining prestige and power is through marriage. A well-qualified son of a less wealthy lineage may be able to marry a girl from a wealthier and more reputable lineage.

Among both Muslims and Hindus, there are three main features in the traditional form of marriage. These features are as follows: (1) the proposal of marriage is initiated by the bridegroom's party, (2) the marriage usually takes place at the bride's home, and (3) marriages are arranged by the parents, other relatives, friends or acquaintances of the parties to be united.

Between Muslim and Hindu marriage practices, however, there are certain differences. Among Muslims, *mahr*, or a certain amount of payment under specific conditions, is to be made by the bridegroom or his family to the bride in every case of marriage. Such an agreement for payment is made to the bride to symbolize her worth as a person to the bridegroom.

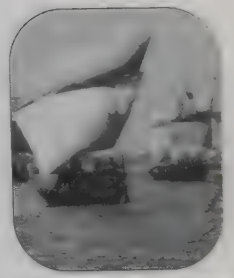
Among the Hindus, in certain cases, the bridegroom is required to be paid a certain cash amount known as *pan,* which is fixed through negotiation by the parties of the bride and bridegroom and paid in whole at the time of marriage. For Muslims, on the other hand, the payment of the *mahr* amount may be made either in cash, in kind or both and partial or deferred payment is allowed.

A Hindu marriage is performed by a priest. Muslims have no priests in the strict sense of the word; any educated man is qualified for the performance of priestly offices, and can perform the rites of a marriage. A Muslim marriage is performed by a respectable related or unrelated male designated as *ukil*, or pleader, with two male witnesses.

Among Muslims, marriage is a contract and usually the terms of the contract are formally documented. The Hindu marriage is a sacrament and needs no formal documentation.

6. LEVEL OF MATERIAL LIVING: 1899 AND 1974

The socio-economic level of a family is reflected in the items of furniture for sitting and sleeping, in the types of eating and cooking utensils, instruments for economic production and miscellaneous implements and receptacles of each household.



Before the development of trade and technology, when the agricultural family possessed the plough and used domesticated animals, considerable economic activity took place in and around the household.

In 1899 the everyday life of the study population was dominated by economic activity around the household. Very little is known about family life in the times of the household dominated economy. Based on the household items of 1899 it is possible to reconstruct an idea of the level of material living.

It is commonly agreed that technology is an important cause of change in economic production. It includes the knowledge and use of inventions and a material culture.

It is from the material contents of the household that the level of technology and standard of living of family members can, to a considerable extent, be assessed.

The changes mentioned in the comparative list of household contents which made a significant impact on the standard of living include the introduction of the following: wooden chairs and tables, mosquito-nets, blankets, aluminium and enamel utensils, power-operated rice mills for husking paddy, tin and steel suitcases, trunks, buckets, wooden cabinets and standard weights and measures.

During the census of 1974, the possession of hurricane lamps, quilts, watches and radios was noted. The findings showed that in the lower income group of agricultural Muslims, 55 per cent of the simple nuclear family households possessed none of these items.

Within the simple nuclear families of the middle and higher income groups, the figures were as follows: middle income group, 38 per cent; higher income group, 23 per cent. Compared with simple nuclear families, larger numbers of extended families owned a combination of these items.

It is interesting to note that in the study area the type of seat offered to visitors or fellow villagers is an indicator of their relative status. From higher to lower status, the seat might be: (1) a chair, (2) a round wooden or cane stool, (3) a low wooden stool or (4) a plank seat.

In many families, these items must be borrowed. A mat is also a common and popular sitting device in the subcontinent. A mat of fine texture is considered more appropriate for a person of higher socio-economic status than a coarse one. In addition to this, the individual with a lower socio-economic status usually maintains a certain level of physical distance as a mark of respect.

Household contents around 1899 were recorded through interviews conducted during field visits in areas not too distant from Matlab by the British Settlement Officer, J.G. Cumming. His findings were published in 1899 (Cumming, 1899). In comparison, the contents of houses around 1974, as noted through observation by the present author, demonstrate certain changes. The introduction of new goods and new methods of production helped in attaining higher standards of living.

Household assets affect the quality of life, particularly in retirement. In an age of low-cost medical care for the aged, household assets allow for the purchase of goods and services which prevent or delay deterioration in health or bring forth quick recovery from illness.

Possession of assets provides opportunities for borrowing and provides a sense of financial well-being and permitting a higher level of consumption (Henretta and Campbell, 1978). In the study area it was observed that during the famine of 1974 certain household assets actually served as a means of procuring food grains in low income families.

The people of Bangladesh compete for meagre resources in a subsistence-level economy marked by a scarcity of land, periodic

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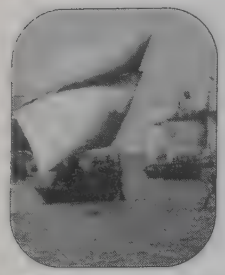

food shortages and an abundance of labour. Despite an annual rate of economic growth averaging 3.7 per cent during the 1980s, high population growth continues to undermine hopes for rapid socio-economic development (Asia Pacific Population and Policy, 1992).

In this context, how the people of Matlab managed themselves when life expectancy rose from 47 to 54 years over the period of 1976 to 1991 is worthy of exploration. The achievement of such an objective in Matlab society can be understood by focusing on the use pattern of a wide variety of key kin terms.

In Matlab the use of the fictive kin term is a part of everyday communication both inside and outside the village.

The fictive kin relationship helps a great deal in obtaining goods on credit. The middlemen, who purchase commodities such as jute, potatoes, paddy, vegetables, eggs and chickens from the producer by making home visits to different villages, invariably use an appropriate fictive kin term while addressing and negotiating with the seller.

In such a patron-client relationship the use of fictive kin terms is very fruitful. A patron is one who does more than provide work and income for his clients. He helps clients in times of crisis by providing credit and by looking after the welfare of the client's children particularly in respect of education and employment.

Frequently, the patron intercedes with various powerful people on the client's behalf and even protects him against those who are hostile. In turn, the client is more than an employee. He is a helper at the time of need and crisis. He is a reserve source of strength for the patron and vice versa.

The ICDDR,B field workers have now been in touch with Matlab community members for over 30 years. During this long period of contact with the people, they have proved themselves to be honest and helpful. Such a record of honesty in public dealings over a long period of time is unheard of in the locality.

It is with this capital that the ICDDR,B has been able to conduct so much valuable community-based research in the villages of Matlab.

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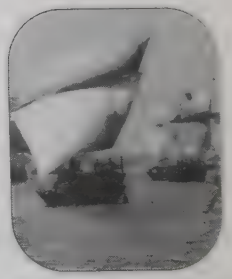
Matlab: Setting and Background

The ICDDR,B field workers have now been in touch with Matlab community members for over 30 years...they have proved themselves to be honest and helpful....

It is with this capital that the ICDDR,B has been able to conduct so much valuable community-based research in the villages of Matlab.



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A glimpse of Matlab bazaar from a distance

On the 6th of December, 1978, the International Centre for Diarrhoeal Disease Research comes into being following an Ordinance made by the President of the People's Republic of Bangladesh

[*Published in the Bangladesh Gazette, Extraordinary, dated the 9th December 1978.*]

GOVERNMENT OF THE PEOPLE'S REPUBLIC OF BANGLADESH

MINISTRY OF LAW AND PARLIAMENTARY AFFAIRS

NOTIFICATION

Dacca, the 9th December, 1978.

No. 920-Pub.—The following Ordinance made by the President of the People's Republic of Bangladesh, on the 6th December, 1978, is hereby published for general information :—

INTERNATIONAL CENTRE FOR DIARRHOEAL DISEASE RESEARCH, BANGLADESH ORDINANCE, 1978.

Ordinance No. LI of 1978.

AN

ORDINANCE

to provide for the establishment of an International Centre for Diarrhoeal Disease Research, Bangladesh.

WHEREAS it is expedient to provide for the establishment of an international centre for diarrhoeal research in Bangladesh with multinational scientific collaboration and financial contributions to conduct research in diarrhoeal diseases and directly related subjects of nutrition and fertility with special relevance to developing countries and for matters ancillary thereto;

NOW, THEREFORE, in pursuance of the Proclamations of the 20th August, 1975, and the 8th November, 1975, and in exercise of all powers enabling him in that behalf, the President is pleased to make and promulgate the following Ordinance:—

1. **Short title and Duration.**—(*1*) This Ordinance may be called the international Centre for Diarrhoeal Disease Research, Bangladesh.

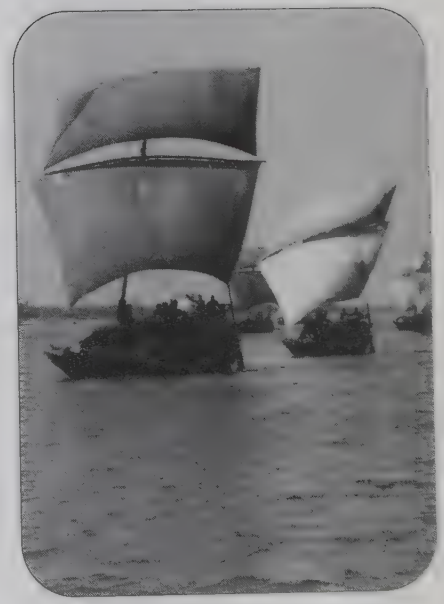
(*2*) It shall continue in force for a period of 25 years.

Price: 35 paisa.

CHAPTER 3

Historical Perspective and Methodology of the Matlab Project

K.M.A. Aziz
W. Henry Mosley



Matlab has the largest continuously operating population surveillance system in the world. It was established in 1963 by the Pakistan-SEATO Cholera Research Laboratory (PSCRL), the predecessor of the International Centre for Diarrhoeal Disease Research, Bangladesh (ICDDR,B) which was chartered in 1978 for the purpose of field testing cholera vaccines.

Consequently, the organization of the Matlab field operations was driven at the outset by rigid technical and ethical requirements for the implementation of prospective double-blind controlled vaccine field trials. These high scientific standards have provided the model for field operations in Matlab ever since.

Over three hundred national and international scientists have been involved directly or indirectly in research projects in Matlab over the past three decades, resulting in no fewer than 567 papers and publications produced to date (Habte & Strong, 1990).

This paper will highlight major elements in the design and implementation of Matlab field operations and related data management issues. These will be discussed in the context of the technical requirements for some of the major research projects that were carried out in the Matlab area. Major attention will be given to the establishment and evolution of the Demographic Surveillance System (DSS) as this provides the foundation for all other field research projects.

In addition, some operational issues related to a number of specialized prospective research projects will be briefly noted, particularly those that involve intensive in-depth study of subpopulations, using a variety of measuring instruments from the biomedical and social sciences. We will not, however, deal with the technical issues surrounding computer management of the large and complex data bases being generated by the DSS.

The text of this chapter is a modified version, reproduced with the permission of the International Union for the Scientific Study of Population (IUSSP) , of a paper by KMA Aziz and W. Henry Mosley presented at the "Seminar on Socio-cultural Determinants of Morbidity and Mortality in Developing Countries: The Role of Longitudinal Studies:, Saly Portugal, Senegal, 7-11 October 1991.

Part I

1. RATIONALE AND METHODOLOGY FOR THE INITIAL RESEARCH OBJECTIVE

The Pakistan-SEATO Cholera Research Laboratory was established in Dhaka, East Pakistan (now Bangladesh) in 1960 to develop, improve, and demonstrate measures for the prevention and eventual eradication of cholera. An essential component of this programme was the implementation of controlled field trials of cholera vaccines.

At the time, it was recognized that field trials of cholera vaccines required certain conditions:

- ☐ cholera had to be endemic;
- ☐ all villages in the area had to be accessible so that long-term, follow-up studies could be undertaken;
- ☐ rapid treatment for cholera had to be readily available at all times;
- ☐ there had to be laboratory facilities for positive identification of cholera in patients with diarrhoea; and
- ☐ the studies had to be scientifically designed, with vaccine recipients properly randomised. These conditions were essential as only microbiologically proven cholera cases could be considered in the protective efficacy of a vaccine.

1.1. Site selection

In 1963, the Director of the CRL, Abram Benenson, together with Robert Oseasohn and M. Fahimuddin, made numerous trips by boat to find a suitable location for the planned and possible future cholera vaccine field trials (Oseasohn, Benenson, Fahimuddin, 1965). Initially some villages of Bhola, then in Barisal District, which were well known for annual cholera incidence, were thought to be a possible site for the study. Matlab was considered

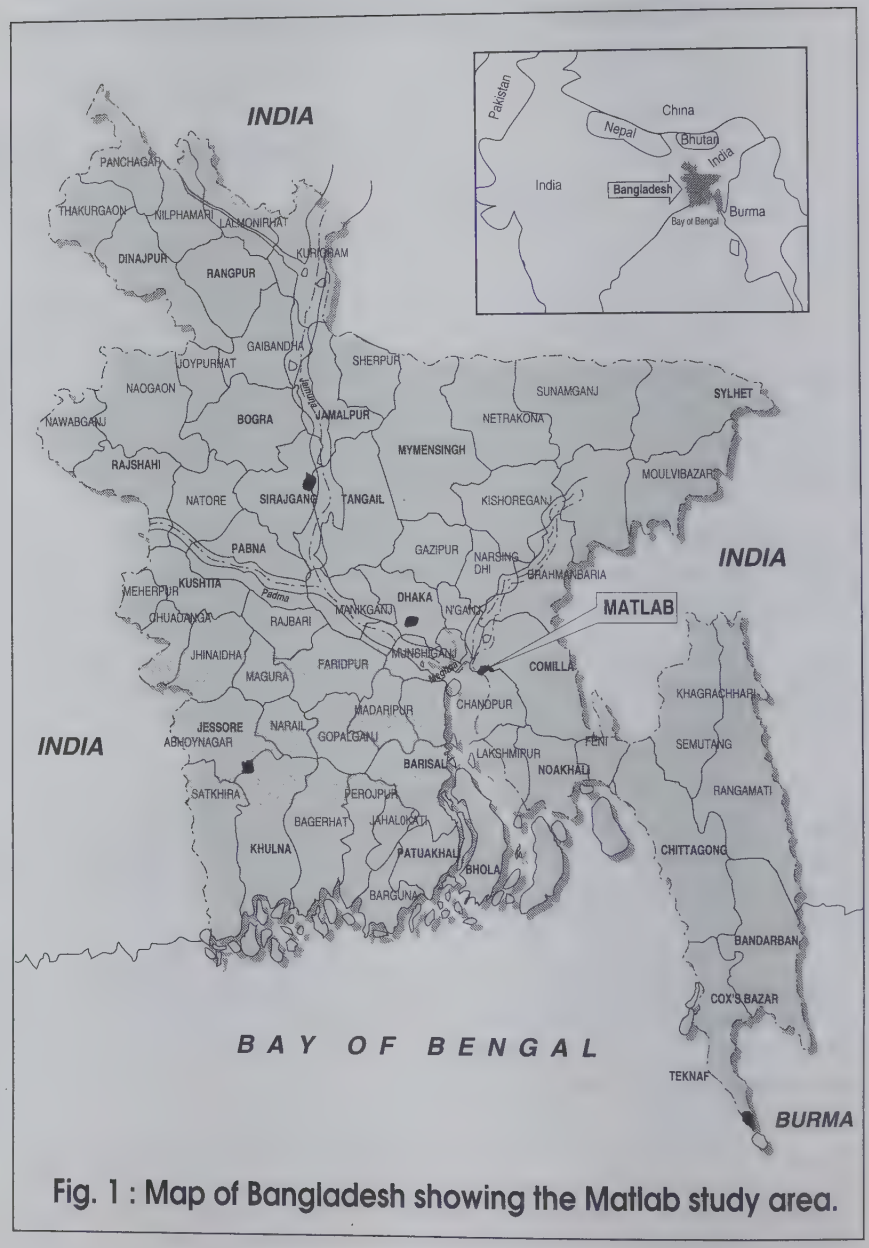


Fig. 1 : Map of Bangladesh showing the Matlab study area.

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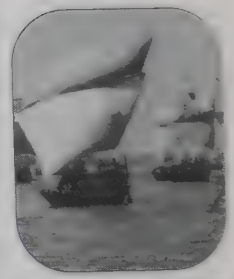
Historical Perspective and Methodology



next since it was known to be the second highest cholera endemic area after Bhola. A low-lying area crisscrossed by several rivers and canals facilitating access, Matlab was also densely populated — so field work could be comparatively efficient. Compared to Bhola, this area was located at a distance that would allow investigators from Dhaka to make a round trip within a day (Figure 1, facing page). In addition, there had been a census of the villages during the smallpox eradication campaign in 1961 and the household census cards were still available and could easily be updated.

1.2. Research Design for Cholera Vaccine Field Trials

Because the annual incidence of cholera in an endemic population is relatively low (about 3/1000), statistical requirements necessitate large populations for vaccine field trials if a protective efficacy greater than 50 per cent is to be established with any degree of confidence. Even larger populations are required in case only a subgroup (e.g. children aged under 15 years) is included in such a field trial.

The basic design of a controlled field trial of a cholera vaccine involves taking a complete census in the villages under study and assigning an identifying census number to every individual (Table 1, right). The vaccine to be tested and a control vaccine (usually a typhoid vaccine or tetanus toxoid) are coded and randomly assigned to individuals in the census books.

The vaccines are then administered by vaccine teams going house to house, locating each recipient by census number and administering the assigned vaccine.

In a "double-blind" study, neither the vaccinator nor the recipient knows which is the cholera or the control vaccine. In order to detect all cholera cases, field workers must visit every household regularly to make inquiries about the occurrence of acute diarrhoeal illnesses and to obtain rectal swab cultures.

TABLE 1

Elements in the Design and Implementation of Cholera Vaccine Field Trials

A. Preconditions
Endemic cholera must be present. Study population size must be large enough to detect a significant effect of a cholera vaccine in reducing the incidence of cholera associated diarrhoea episodes.
B. Elements in the Design and Implementation
Baseline census - to assign individual identifying numbers. Provision of each individual and household with census record card. Random allocation of cholera vaccine(s) and control vaccine (by code letter) to individuals listed in census books. "Double-blind" administration of assigned vaccines and recording in census book. Daily house-to-house surveillance for all severe diarrhoeal episodes. (Home visits recorded daily on household census card.) Rectal swab culture of all moderate diarrhoea at home with daily shipment to laboratory. Immediate rapid transport (speed boats) of severe diarrhoea cases to research treatment center. All field surveillance, clinical and laboratory records identified by individual census number to link records for data analysis. Vaccine code broken at end of study to analyze per cent reduction in cholera case rate among cholera vaccine recipients as compared to control group.

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Historical Perspective and Methodology

TABLE 2

Demographic Landmarks in Matlab, Bangladesh 1963-1988

Year	Event	No. of Villages	Population	Covered by Household Surveillance[b]	
				Villages	Populations
1963[a]	New Census	23	27,629	(23	28,000)[c]
1964[a]	New Census	+35	32,548	(58	62,000)[c]
1966[a]	Re-census 1963/64 population	58	111,748	132	112,000
	New Census	+74			
1968[a]	New Census	+101	109,402	233	226,000
1970	Update 1966 Census	132	~124,642	233	277,000
1974[a]	Re-census All	233	274,979	233	277,000
1975	Contraceptive Distribution Project				
	Treatment Villages	150	140,000		
	Control Villages	83	136,000		
1977	Reduce Study area	(-84	-105,000)	149	174,000
1977	Family Planning - Health Service Project[d]				
	Treatment Villages	70	89,000		
	Control Villages	79	85,000		
1978	Update 1974 Census	149	174,443	149	174,500
1982	Update 1978 Census	149	~187,574	149	188,000
1984[a]	Population Estimate			149	193,000
1988	Population Estimate			149	200,000

[a]Years Cholera Vaccine Trials were initiated.

[b]Frequency of household surveillance:
- 1963-70 Daily
- 1970-71 Irregular (war)
- 1972-74 Every 1-2 days (?)
- 1974-78 Every 2-3 days
- 1978-Fortnightly

[c]From 1963-65, only diarrhoea/cholera surveillance was carried out. Demographic surveillance began in 1966.

[d]In later publications this project is referred to as the Maternal and Child Health - Family Planning Project (MCH-FP)

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Whenever a field trial is initiated in a new population (as was the case for the first four field trials initiated between 1963 and 1968) daily surveillance is critical to the study design for ethical as well as scientific reasons.

Without treatment, the acute diarrhoea of cholera can be fatal in a few hours; since death is an unacceptable outcome in any research, a field hospital in a central location with 24-hour speedboat ambulance service was essential to provide rapid treatment for all severe, acute diarrhoeal cases detected.

In the early years, daily home visits were necessary, as people were not accustomed to taking cholera cases to hospitals since, in their experience, severe cases were always fatal.

All records from the field, the hospital, and the laboratory were linked by the individual census number of each case. These linked records were then analysed to assess the protective efficacy of the vaccine.

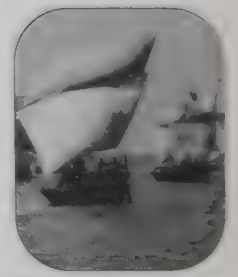
1.3. The Major Cholera Vaccine Trials Conducted in Matlab:

1963-64: The first carefully controlled field trial of an injectable cholera vaccine tested a very high-potency whole-cell vaccine and found that it gave significant protection for about two years (Oseasohn, *et al.*, 1965).

1964-65: A second trial of the same vaccine showed that it was only effective for about 18 months after vaccination. Concurrently, a test of a vaccine based on the endotoxin of the Ogawa serotype produced some immunity — but only for a period of about one year (Benenson, *et al.*, 1968).

1966-69: The effects of one and two doses of a standard cholera vaccine, given to children aged under 14 years, were tested and showed that children aged from 0 to 4 years benefited from two doses (Mosley, *et al.*, 1969). Annual booster doses were also beneficial but the effects were short-lived (Mosley, *et al.*, 1972).

1968-69: Testing monovalent Inaba and Ogawa vaccines seemed to show that immunity depended on the development of serotype-specific immunity, although this was later questioned (Mosley, *et al.*, 1970).



1974-75: After several years of vaccine development in the U.S. and the U.K., which resulted in an injectable cholera toxoid vaccine, the largest field trial to date was carried out involving some 93,000 recipients; unfortunately, it showed only 40 per cent protection which lasted only about three months (Curlin, *et al.*, 1978).

1985-89: Given the poor success with injectable vaccines, researchers developed an oral vaccine based on a part of the cholera toxin (B-subunit) that produces intestinal immunity but no disease. After ten years of research, two orally-administered vaccines — one a combination of killed whole cholera cells *with* the B-subunit of cholera toxin, and the other the killed whole cells *alone* — were ready for field testing.

Over a five-month period in 1985, some 63,000 people received three doses of one of the vaccines or a placebo. *Both vaccines provided 57 per cent protection after two years;* some protection extended to the *third* year but children aged less than 5 years had a lower rate of protection (Clemens, *et al.*, 1988).

2. THE STUDY POPULATION: DEMOGRAPHIC LANDMARKS

As noted above, the selection of the study area, the determination of the population size, and the structure and organization of field surveillance activities were defined by the requirements of the first four vaccine field trials between 1963 and 1968, which successively expanded the study area (Demographic Surveillance System, 1978).

In subsequent years, the surveillance system was modified and the population size adjusted for demographic and other considerations. These developments are described below and summarized in Table 2 (facing page).

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Historical Perspective and Methodology

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Historical Perspective and Methodology

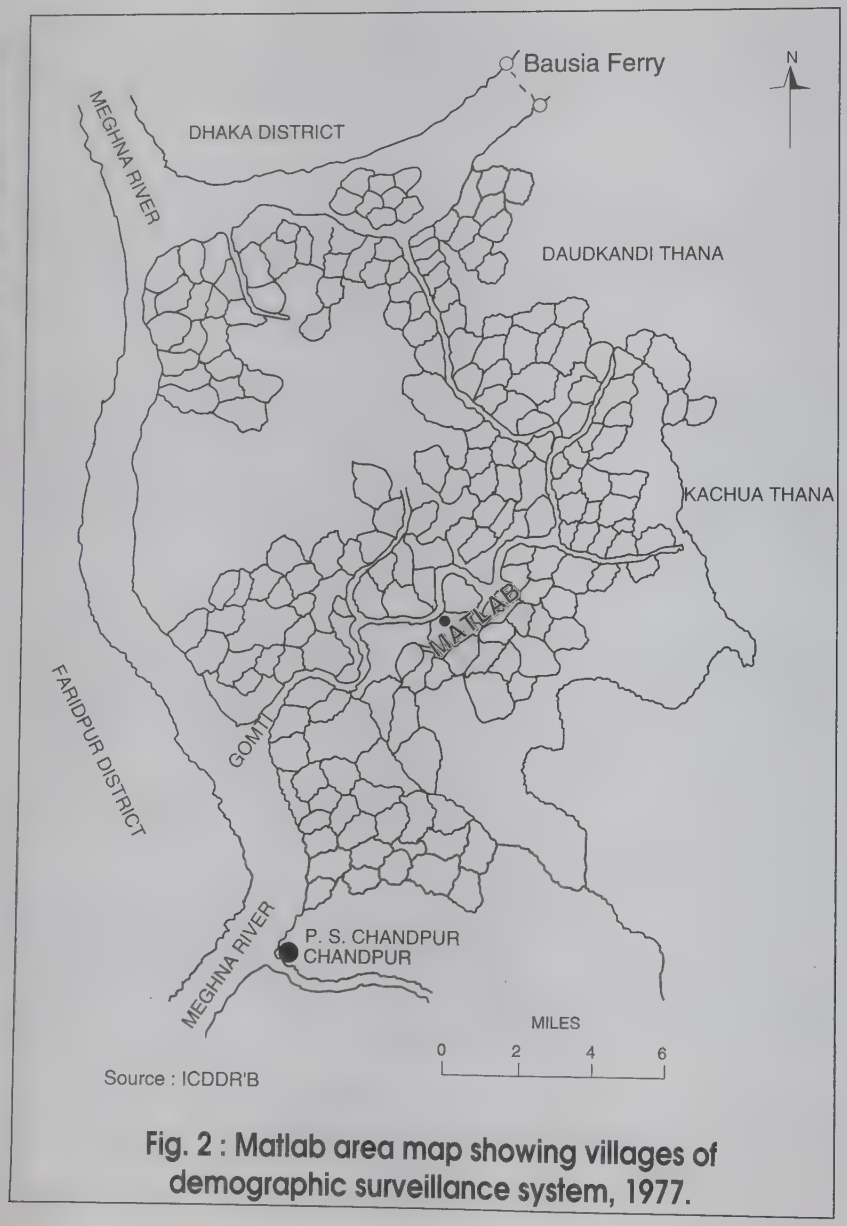


Fig. 2 : Matlab area map showing villages of demographic surveillance system, 1977.

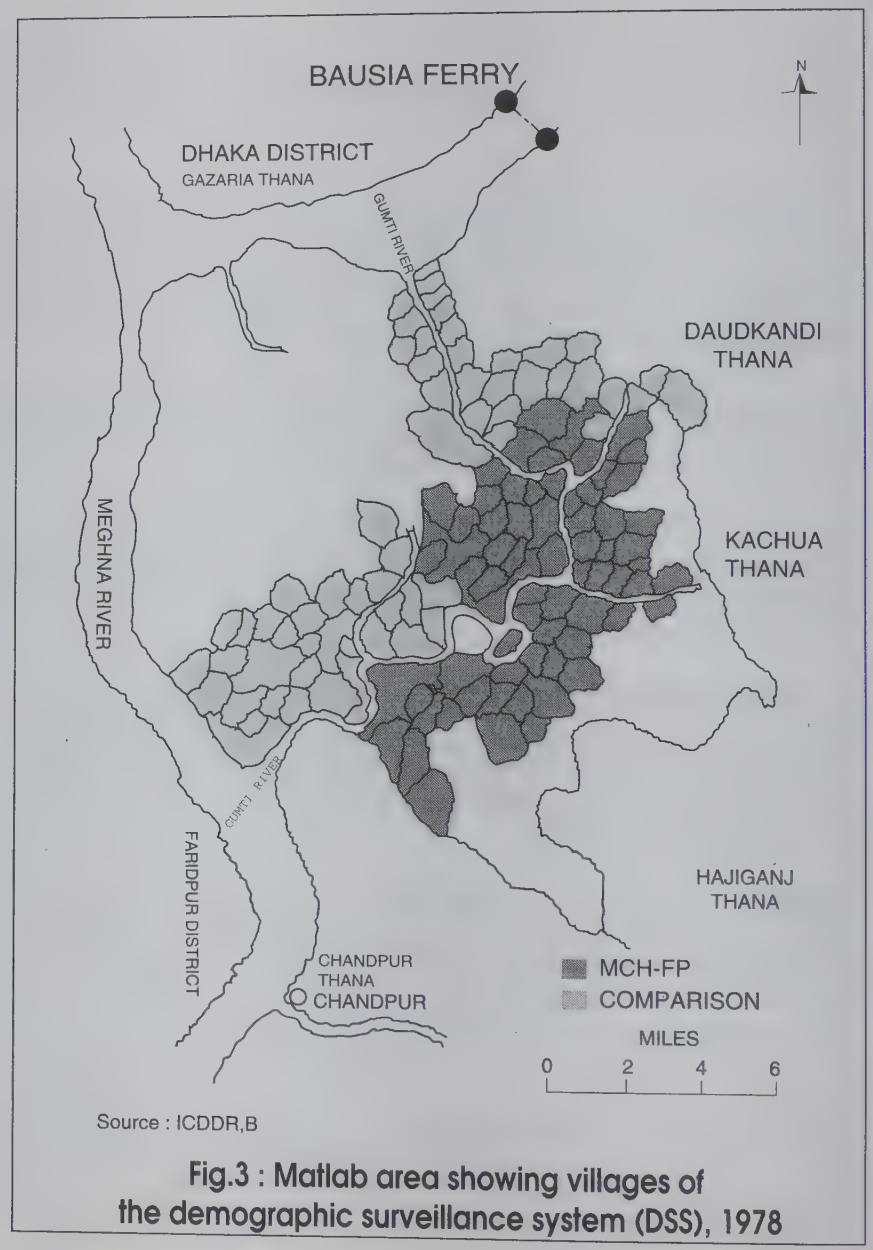
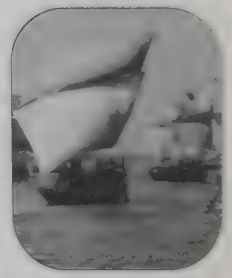


Fig.3 : Matlab area showing villages of the demographic surveillance system (DSS), 1978



2.1. Population Size:

The first of the cholera vaccine field trials of PSCRL was launched in 23 villages with a population of 27,629. In 1964 the field trial area was expanded to include an additional 35 villages with a population of 32,548. The trial area was further expanded in 1966 to cover an additional 74 villages. The total population of 111,748 in 132 villages was later referred to as the Old Trial Area (OTA).

Beginning in May 1966, following the census, a regular registration of births, deaths, and migrations was initiated in the 132 villages (Aziz, *et al.*, 1967; Mosley, *et al.*, 1968; Demographic Surveillance System, 1978). This continuous (daily) monitoring of vital events generated data of a very high standard, as these demographic events could be independently verified by supervisory staff, thus serving as a means of checking on the quality of daily diarrhoea surveillance activities.

To have another population for a new vaccine trial, the area was further expanded in 1968 by the addition of 101 villages covering a population of over 109,402. This population was referred to as the New Trial Area (NTA). Daily demographic surveillance now covered 226,000 in 233 villages.

In 1974, in preparation for the toxoid vaccine field trial, the entire population of the surveillance area was re-enumerated, showing a total count of 276,984 in the 233 villages (Ruzicka and Chowdhury, 1978). In October 1975, a household Contraceptive Distribution Project (CDP) was initiated in 150 villages representing one-half of this total population (Huber and Khan, 1979; Rahman, *et al.*, 1980).

Economic constraints at the ICDDR,B led to a major modification in field structure and programme activities in October 1977 with a reduction in the surveillance area. Eighty-four villages with a population of about 105,000 had to be excluded while 149 villages with a total of 174,443 inhabitants were retained in the surveillance area (Becker, *et al.*, 1982).

The Maternal and Child Health-Family Planning and Health Services Project (MCH-FP) was then launched in 70 villages with a population of 89,000, and the remaining 79 villages with 85,000 persons were used as a comparison area (Bhatia, *et al.*, 1980). Figure 2 (facing page) shows the 233 villages covered from 1968 to 1977, while Figure 3 shows the 149 villages divided into MCH-FP and comparison areas.

2.2. The Demographic Surveillance System

The Demographic Surveillance System (DSS) consists of the registration of births, deaths, marriages, divorces in- and out-migrations and internal movements (Demographic Surveillance System, 1978). There are also periodic censuses along with socio-economic information of the study population. The censuses were done on the basis of a *de jure* count.

The following sections describe the censuses and surveillance with reference to its changes over time. Special note is made of the numbering system since this relates to the many cohort (record linkage) studies that have been done with the Matlab data over the years. Over the years these data have been managed with increasing sophistication, with frequent updating of the ICDDR,B computer facilities. In 1986 an IBM mainframe System 4361 was installed and new software is being developed to establish a relational dynamic data base.

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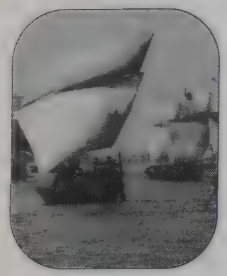
Historical Perspective and Methodology

Census of the Old Trial Area, 1966:

Residents of each household were listed by assigning an 8-digit identification number. The identification number consisted of two parts: the first 3 digits identified the village and the last 5 digits identified an individual within a village, e.g. the first individual in village V12 would be V12-00001. In each village, the individual numbers started from unity and were continued, household by household, until the entire village was covered.



At the completion of the census, three copies of typed census volumes were prepared: one for field workers, one for the Matlab office and one for the Dhaka office. After receiving the volume, field workers issued a family register for every household. Family registers of a *"bari"* (contiguously located patrilineally related households around a central courtyard) were grouped together as one household for surveillance purposes.

Demographic Surveillance of the Old Trial Area, 1966-70:

The demographic surveillance in this period was limited to the registration of births, deaths, and migration into or out of the study area. The causes of death were based on verbal reports by relatives of the deceased, which were classified into 9 to 27 categories at different times over the ensuing years. The cause of death reporting in the Matlab area was extensively reviewed by Zimicki, *et al.*, (1985).

The numbering system in the 1966 census, while satisfactory for the vaccine trial, proved deficient for demographic studies. For example, a live-birth occurring after the census was given the mother's identification number followed by a letter, e.g. if the mother's number was V01-00100, the baby was assigned V01-00100/A.

Similarly, an identification number assigned to an in-migrant joining an existing household required the addition of a letter to the number of the last member in the household.

In-migrants creating new households were assigned numbers following the last identification number in the village, *e.g. if the last number in the village was V01-00200, the in-migrants were assigned numbers V01-00201, V01-00202, and so on.*

Change of place of residence **within** the DSS area was not recorded as an event until 1982, but remarks were noted in the census volumes of new and old residence. A registered person changing residence always retained his/her original identification number.

Census of the *New* Trial Area, 1968: Since the identification numbers introduced in the 1966 census were difficult to handle during surveillance, a modified number consisting of three parts was introduced: The first 3 digits identified the village, the next 4 digits identified the household and the last 2 digits identified the individuals within a household, beginning with the head of the household.

This census also included each person's relationship to the household head, occupation, total times married, and the current marital status.

Re-census of the Old Trial Area, 1970: The census procedures and the numbering system were the same as those followed in the NTA census in 1968. Additional socio-economic information, such as education, was also collected in this census.

Census of the Entire DSS Area (OTA *and* NTA), 1974: The census procedures and assigning of identification numbers were the same as in the NTA census of 1968 and the OTA census of 1970. After the census of 1974, minor modifications were made in assigning identification numbers to newborns and in-migrants within an existing household.

Registration of marriages and divorces was introduced for the first time in January 1975. By this time the Demographic Surveillance System was on a more systematic foundation and the first of a regular series of annual DSS Reports began to be produced.

Contraction of the DSS Area and Census Update, 1978: In August 1977 the DSS area was reduced to 149 villages. At this time the population database was again updated by verifying

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Historical Perspective and Methodology

computer printouts of the 1974 census, adjusted for births and deaths, with the actual situation in the field.

Census of DSS Area, 1982: During this census, *dual numbering* was introduced for the first time. This was particularly advantageous in tracking persons who changed residences. As noted above, the DSS census number identified an individual's location at the time of enumeration and was nine digits: the first 3 digits for village, the middle 4 digits for household, and the last two digits for the individual in a household.

The **new** 'registration number' was 10 digits and would be **permanent** for an individual. The first digit showed in what period the individual was included in the DSS. Anyone who was enumerated on or before 31 June, 1982, had "1" in the first column and the remaining nine digits were the 1974 census number. Provision was made for recording both a current location and the permanent registration numbers on forms.

If there was a birth or an in-migrant (new) in an existing household, he/she was assigned a current location number (village and household were identical with the other members but an individual number followed the last member in the household) *and his/her current number was converted to the permanent registration number* by adding 2 at the beginning.

In cases where a registered individual moved from one village to another *within* the surveillance area, he/she was assigned a *new* current location identification number but his/her permanent registration number would be retained.

3. FIELD STAFF SELECTION AND MANAGEMENT ISSUES

The administrative structure for management of the field staff has mostly been hierarchical. This structure was adopted after taking into account the social, cultural, and logistic conditions and constraints existing in the Matlab area. Over the 18 years that the field surveillance activities have been in existence, only one fundamental reorganization in the field activities was introduced. This occurred in 1977-78 when the Maternal and Child Health-Family Planning Operations Research project was initiated (Bhatia, *et al.*, 1980).

Table 3 (overleaf) shows the staffing and organization of the field surveillance activities from the year 1968, when the population under surveillance had reached 240,000.

In fact, this same structure existed from the inception of the project in 23 villages in 1963. As a rule, the senior supervisor has been a university graduate in social science, while the next level of supervision was managed by individuals with at least two years of post-high school training in sanitary inspection or the equivalent. Generally, these persons have been experienced professionals from the Ministry of Health or the military. These senior-level staff were recruited nationally and generally did not come from the Matlab area.

The field assistants (later designated health assistants) were all recruited locally from the Matlab area. Persons at this level require a minimum of a high school graduation and are responsible for recording all vital events and other activities in the field area.

At the time, cultural constraints required that all of these workers be male so that they had the personal mobility required by the project. These men, however, could not go freely into any village when the women's husbands were not present because of the conservative customs of this Islamic society.

Consequently, in every village at least one mature woman (locally called a *"dai"*) was recruited to escort the field assistant or other field staff through her village. Typically, this was a poor illiterate widow past child-bearing age who had the freedom of mobility

CONTINUED...

TABLE 3

Staffing and Administrative Organization of Field Surveillance Activities Matlab 1968 to Present

Surveillance Worker	Number	Average Population Per Worker	Visitation Cycle
	a. 1968-74		
Field Surveillance Supervisor	2	120,000	random
Sanitary Inspector	14	17,000	monthly
Field Assistant	50	4,800	weekly
Dai (female worker)	300	800	daily
	b. 1974-77		
Supervisor	1	280,000	random
Field Surveillance Assistant	3	93,000	random
Senior Field Assistant	4	70,000	4 months
Field Assistant	16	17,500	1 month
Dai	290	900	2-3 days
	c. 1978-		
Senior Field Research Officer	1	159,000	random
Field Research Officer	3	53,200	random
Senior Health Assistant	6	26,600	2-3 months
Health Assistant	12	13,300	monthly
Community Health worker	80/30[a]	1000/2700[a]	biweekly/weekly[a]

[a] From 1978 the area was divided into the Family Planning - Health Service Area with 80 Community Health Workers (CHWs) and the control area with 30 CHWs. The population covered and the intensity of coverage were different. (See text).

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required for such work. As noted in Table 3, facing page, up until 1977 the daily household-surveillance checking for births, deaths, and episodes of diarrhoea was carried out by the *dai*. Typically, her work area was assigned so that she could complete inquiries in all the households in about two or three hours. Acute diarrhoeal episodes were reported to the field assistant on a daily basis for examination and rectal swab cultures.

Up until 1974 the field assistant visited each household weekly and from 1974 to 1977 monthly, and registered vital events, and updated and signed the household census card. The sanitary inspector (later designated senior field assistant) had a systematic schedule entailing monthly (later at 4-month intervals) visits to every household to confirm vital events and check the visitation schedule on the household census card.

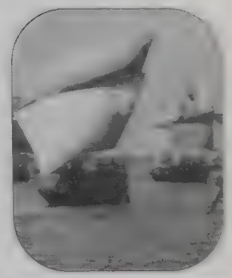
The fundamental organizational change initiated in 1977 was the replacement of the large number of illiterate *dais* with a smaller number of younger married women with a high school education who were designated Community Health Workers (CHWs). This was done for three reasons:

- first, the design of the MCH-FP project required that household visits to motivate mothers to practise contraception and to teach them about maternal and child care be done by young married women who themselves were practising contraception (Simmons, *et al.*, 1988);

- second, by 1977 there was a sufficient pool of educated young married women in the Matlab area available for this work to make recruitment feasible;

- third, over the preceding decade, the tumultuous political and economic changes, including civil war and famine, had initiated such a social transformation that it was becoming more and more acceptable for young married women to take up this kind of work.

As shown in Table 3, there were 110 of these community health workers unequally divided between the two halves of the surveillance area, as required by the MCH-FP project design.



The 80 field workers in the MCH-FP project area carried with them a record book, which had a detailed Record-Keeping System (RKS) for routinely monitoring contraceptive use and reproductive status (pregnancy, breast feeding, lactational amenorrhea, etc.) of each woman in the field worker's area (Bhatia, 1982).

This specialized record-keeping system was maintained independently of the data collection by the demographic surveillance system. It is noteworthy that these 80 community health workers in the MCH-FP area additionally received technical supervision from four female welfare visitors who had received two years of paramedical training following their secondary school education (Bhatia, 1981).

Management Problems Encountered: A major source of low morale among the field staff is insecurity about their jobs because they are always working on time-limited projects and lack information about future activities. In general, field staff are not aware of projects under development where they might have an opportunity for involvement.

Coupled with this, lack of communication between different levels of workers and worry over the continuation of the Matlab project can lead to a breakdown of morale. Staff waiting with uncertainty for project assignments may express jealousy towards staff members who are assigned to well-funded projects. And then selection for long-term versus short-term assignments can create tensions among staff. Finally, as with any organization offering opportunities for employment, relatives and others can create pressure on the project administration for positions.

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4. CHANGES IN THE STUDY OBJECTIVES OVER THE YEARS

Up until the mid-1970s, the research agenda in the Matlab area was limited to the field testing of new technologies (e.g. vaccines) or carrying out basic research on diarrhoeal diseases, nutrition, and the dynamics of population change.

In 1975 there was a major shift in research strategy with the initiation of the Contraceptive Distribution Project (CDP) (Huber, *et al.*, 1979). In 1977 the CDP and its successor, the Family Planning-Health Services project (FPHS), moved the ICDDR,B for the first time into population-based intervention studies which required behavioural changes in the village women to produce a sustained demographic impact (Rahman, *et al.*, 1979).

At the outset, the strategy of the CDP project was strictly top-down, using existing field staff to provide contraceptive commodities (initially pills and condoms and, later, injections) on a house-to-house basis.

Subsequently the FPHS project, which took a more client-oriented approach, began offering a wider range of contraceptives (IUDs and sterilization) with medical backup and, over the years, additional MCH services were added (Phillips, *et al.*, 1984; DeGraff, *et al.*, 1986).

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Still, as will be noted below, up to the present the programme strategy has been essentially top-down with little effort to institutionalize these programmes in the communities (Phillips, *et al.*, 1988).

Organization and Operation of the Contraceptive Distribution Project and the Family Planning-Health Services Project

At the beginning of the Contraceptive Distribution Project (CDP) there were 233 villages with an estimated population of 276,000 as of 1975 in the Matlab DSS area.

The CDP involved free distribution of oral pills and condoms on a house-to-house basis to half the population of the DSS area; the other half of the DSS area served as a comparison group.

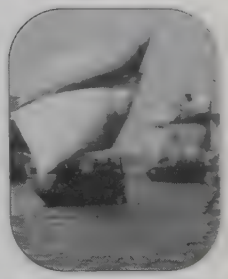
One hundred and fifty-four of the existing female village workers (*dais*) were briefly trained to work as distributors and depot-holders for the two types of contraceptive (Rahman, *et al.*, 1979).

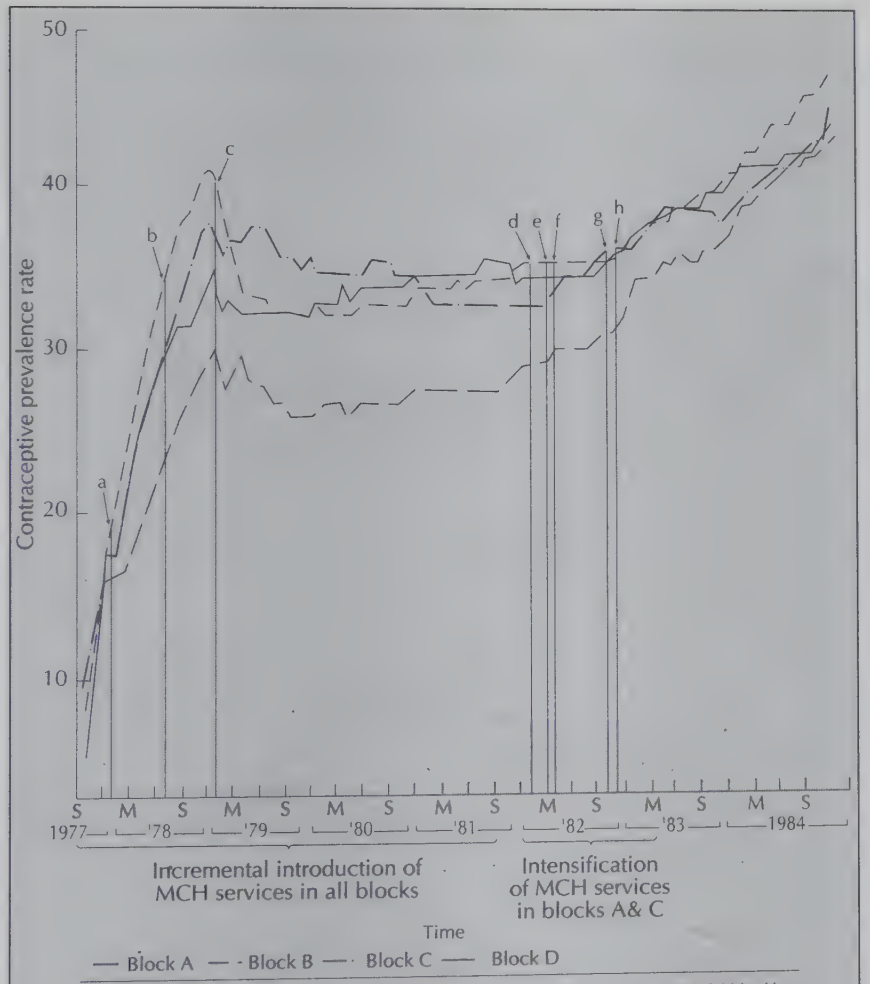
The initial results of the CDP were encouraging. Within three months following the initial mass distribution, the percentage of married women of reproductive age currently using contraceptives, mainly oral pills, rose from a base-line level of 1 per cent to about 18 per cent at three months; however, only about one third of the acceptors kept up sustained contraceptive use for even one year (Rahman, *et al.*, 1980). The resulting demographic impact of the programme was only temporary and largely limited to older women (Stinson, *et al.*, 1982).

In late 1977, the modified programme known as the FPHS Project, replaced the *dais* with a cadre of 80 female Community Health Workers (CHWs) who were backed up by strong supportive supervision and technical staff to provide a full range of contraceptives and selected MCH services in 70 villages (Bhatia, *et al.*, 1980). The CHWs were locally recruited, all of them literate, young married women.

They initially received a two-week training in human reproduction and fertility control technology, followed by two weeks of closely supervised field training (Bhatia, 1981). Subsequently, in weekly sessions, they were gradually given additional training in maternal and child nutrition, tetanus toxoid immunization and oral rehydration for diarrhoea.

Each CHW serves a population of about 1,000 (or about 200 families) and almost all of them reside in the village or area where they work. A group of 20 CHWs is assigned to a subcentre, staffed by a full-time paramedic, which provides





Note: All blocks had family planning services; Blocks A and C also had intensive maternal/child health care services, and Blocks B and D had limited maternal/child health care services. Services are represented as follows: a = IUD insertion; b = tetanus vaccine to pregnant women; c = oral rehydration therapy; d = tetanus vaccine to all women in Blocks A and C; e = measles vaccine in Blocks A and C; f = IUD home insertion; g = antenatal care in Blocks A and C; h = training of traditional birth attendants in Blocks A and C. On the X-axis (Time), M is March and S is September. [a]Family planning services were introduced in October 1977.

Fig 4 : Time trend in contraceptive use prevalence in four service areas of the Family Planning-Health Services Project, 1977 to 1984

routine maternal and child health services, IUD services, menstrual regulation services and referral support.

Work routines require each CHW to visit all currently married women of reproductive age in the CHW's area fortnightly and provide conventional contraceptives (condoms and oral pills) and DMPA injections at the house of the client. The project has one female physician who does regular rounds in the field and provides professional support to a central sterilization clinic in the Matlab headquarters.

The plan of the FPHS project was to incrementally assign comprehensive MCH-FP duties to the CHW: general family planning services, comprehensive immunization services, antenatal and postnatal care, nutritional education and treatment of diarrhoeal diseases. Accordingly, the development of the project proceeded from general training of CHWs to a gradual introduction of all these duties.

The effect of the MCH-FP project was a prompt rise in contraceptive use-prevalence rates, reaching 32 per cent in the first year. The project maintained this use-prevalence rate for five years; since 1983 the prevalence has again risen, *reaching almost 50 per cent in recent years.* Figure 4, left, shows the time trend in contraceptive acceptance and the timing of introduction of other interventions from 1977-84 (DeGraff, *et al.*, 1986).

An analysis of the demographic impact of the project showed that by 1979 fertility in the MCH-FP area was 25 per cent lower than in the comparison area (Phillips, *et al.*, 1982).

Recent analysis of the DSS data suggests that the project is making a significant impact on infant and child mortality (D'Souza, 1986) and on maternal mortality (Fauveau, *et al.*, 1988). The demographic trends in the Matlab project from 1967 to 1987 are illustrated in Figure 5 (overleaf), which shows the impact of the FPHS project since 1978 on fertility and mortality (Menken and Phillips, 1990).

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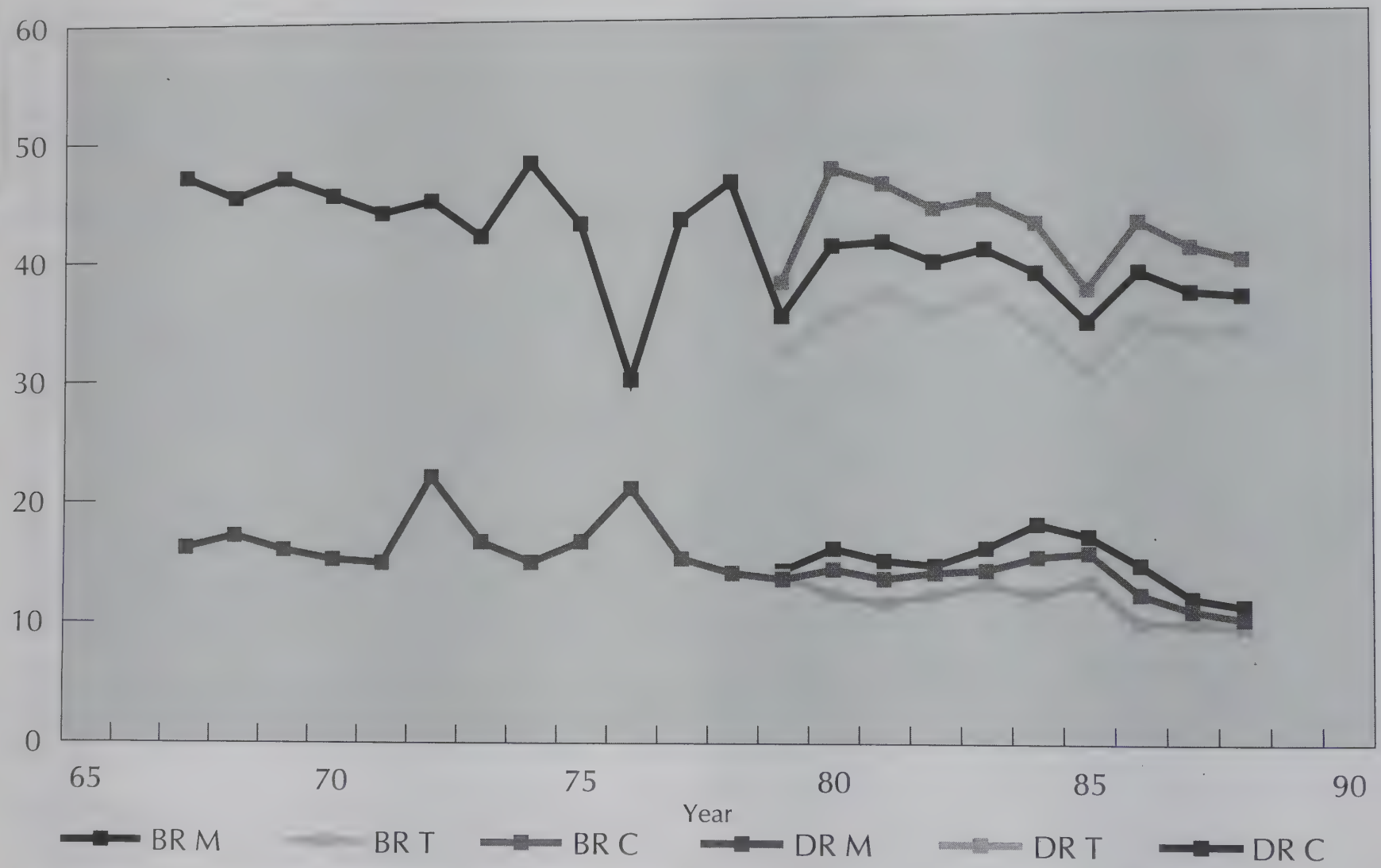

Sources : Publications of the Demographic Surveillance System for the various years; annual reports of the International Centre for Diarrhoeal Disease Research, Bangladesh.

Fig 5 : Birth (BR) and Death (DR) Rates : Matlab (M) 1967-87; Treatment (T) and Comparison (C) areas, 1978-87

5. HUMAN RELATIONS: COMMUNITY PERCEPTIONS OF THE MATLAB PROJECT

From the outset the Matlab project has had an unwritten understanding with the community members according to which the project was ready to treat cholera patients promptly once patients from the community were brought to the field hospital.

Until the early 1970s, all diarrhoea patients were carried by project ambulance-boats to the field hospital at Matlab for prompt attention by the physician. Such dramatic life-saving treatment of cholera, which is appreciated by everyone, has been a key factor in building and maintaining an excellent rapport between the project and the local community.

The Matlab Field Hospital provides free treatment to all members of the community suffering from diarrhoeal diseases, whether they occur within or outside the surveillance area.

The number of patients served from 1963 to 1988 was 204,388. This figure includes mostly in-patients, but also out-patients up to 1977 (Habte and Strong, 1990).

Since entirely free service in treating a deadly disease like cholera was an unknown concept to the people of Matlab, this service amply proved the sincerity and dedication that the staff members of the project invested in saving the lives of the people.

The support of the field hospital to the diarrhoea-stricken community members led to a lasting bond of friendship between the project and the people, which over the years has enabled researchers to successfully undertake many investigations.

These include cholera vaccine trials, research on oral rehydration therapy, clinical research which included studies on drug trials, search for pathogens, and bringing diagnostic tools closer to the field, and in-depth epidemiological and population studies. That is not to say that difficulties were not encountered from time to time. Some of these are highlighted below.

Public Relations Problems: Popular magazines and newspapers often published stories about the Matlab project. This provided information throughout Bangladesh to medical professionals, teachers, students, and other elite sections of society.

Unfortunately, at times these reports criticised or misrepresented the activities of the ICDDR,B based on local sources of information about what was happening in the various field programmes. Frequently this involved misinterpretation of what was actually going on in the field research projects where the activities had an impact on large numbers of people.

This included such activities as administering injectable and oral vaccines; mass (finger stick) blood collections; sample surveys collecting such specimens as rectal swab cultures, urine, or breast-milk; and contraceptive field studies involving injectables, IUDs, different oral contraceptives or surgical sterilisation. In the early years of the project, too often insufficient attention was given to the press until some misleading story had already been published.

Presently, far more attention is given to effective public relations to communicate the programmes and activities of the ICDDR,B.

Community Relations: Many project activities created misunderstandings among the villagers in the Matlab area that considerably hampered the field work and often required extensive effort to rectify the situation. The implementation of the vaccine trials, because they involved such a massive direct intervention into these conservative communities, typically generated many rumours that had to be countered.

The adverse reactions in the village were undoubtedly compounded by the fact that the vaccine teams used sophisticated

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jet injectors rather than more familiar syringes and needles to administer vaccines. Furthermore, the minor side-effects related to the immunization procedure (fainting, local pain, low-grade fever) at times created a sense of panic in the communities.

Examples of rumours were that the vaccine was actually a family planning injection or that the population was being used as guinea pigs for experimentation with a completely new drug which should only be tried on animals.

Many studies involved the collection of blood specimens, typically a single drop by finger prick but in some studies intravenous blood collection. (For example, see McCormack, *et al.*, 1969.)

Because blood is considered a highly valuable item, when IV blood collections were done many people believed that the project was selling their blood in Dhaka. Even finger prick blood collections would create concern among many individuals as the prevailing belief was that the amount of blood in the body was fixed and even the loss of one drop could result in a permanent loss of strength. Because there was insufficient feedback to the community about the reasons for taking blood samples repeatedly, there was tension on a continuing basis.

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Over the years there were multiple in-depth longitudinal studies of communities involving repeated questioning and specimen collection to study the epidemiology of diarrhoeal diseases or the dynamics of birth intervals.

Not surprisingly, many of the questions were considered sensitive by the community which led to embarrassment and reluctance to respond. For example, the epidemiological studies pursued questions on personal habits including defaecation practices, personal hygiene, and food preparation which were considered private (Spira, *et al.*, 1980; Black, *et al.*, 1982a).

The intensive routine demographic data collection often created suspicions when questions were asked about foetal wastage, still-births, conceptions among unmarried women, induced abortion, self-arranged marriages, and divorce (Demographic Surveillance System, 1978; Aziz, 1978).

Studies of the dynamics of fertility requiring monthly urine collection which would detect extramarital pregnancy (Becker and Chowdhury, 1983) and studies of induced abortion (Fauveau and Blanchet, 1989) were socially sensitive.

Furthermore, there was reluctance to provide information on matters considered very private like menstrual cycle and sexual behaviour (Huffman, *et al.*, 1987; Ruzicka and Bhatia, 1982; Aziz and Maloney, 1985).

The in-depth investigations referred to above were only undertaken after the project had been in operation for five or ten years or more. By that time the field staff had gained a great deal of rapport and credibility with the people.

This was facilitated by the interpersonal skills that the project staff gained over the years, typically building up a 'fictive' kinship relationship with individuals so that it would be appropriate to engage in personal discussions about sensitive issues (Aziz, 1979).

It is noteworthy that it was not until the development of the MCH-FP project in 1977, which employed young married women from the community who themselves used contraception to counsel women about family planning and child care, that the project actually selected and developed a cadre of field staff for the explicit purpose of effective communication with the community in order to implement a social intervention (Bhatia, *et al.*, 1980; Phillips, *et al.*, 1988; Simmons, *et al.*, 1988).

The design of this project followed an in-depth analysis of the preceding CDP project which had been implemented in 1975 by the pre-existing field staff.

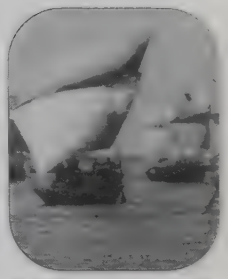
That analysis revealed, in particular, that the *dais* who were asked to distribute oral contraceptives house to house had no credibility in the community for this purpose both because they lacked any personal experience with contraception and because they were typically poor and from the low social classes (Rahman, *et al.*, 1978; Rahman, *et al.*, 1980).

Government Relationships: From 1966 to 1989, the headquarters of the Matlab project were located on the premises of the Matlab Government Rural Health Centre. Occasionally, the sharing of space within the same building created some tension between the project and Government staff members because of lack of sufficient space in the buildings for both parties. To minimise this problem, special administrative contacts were sometimes required between the Matlab project and the Health Ministry officials of the Government of Bangladesh. In February 1990, the Matlab project, now named the Matlab Health and Research Centre, was moved from the Government Upazila (subdistrict) Health Complex to a newly constructed two-storey Health Complex building of its own located only several hundred yards away from the existing building.

In 1982 the MCH-FP Extension Project was established to test the ways in which the successful components of Matlab could be transferred to the government services programme (Phillips, *et al.*, 1984). In addition to working in Matlab, the Extension Project has field sites in two other upazilas in rural Bangladesh:Sirajgonj in Sirajgonj District and Abhoynagar in Jessore District. Service delivery in these areas remains the responsibility of the government, with the role of Matlab project staff limited to research and counterpart support.

6. LEGACY OF THE MATLAB PROJECT

Population surveillance is continuing in Matlab. The last chapter is not yet written, thus the impact of Matlab is continuing to be made. Any attempt to capture the past contributions of Matlab to advancements in science, policy, and programmes in health and population in a brief summary will surely neglect important areas, but a few broad generalizations with selected studies noted for illustration are appropriate.



Work in Matlab has had a profound impact on health and population policy worldwide.

While the results of the cholera vaccine trials in the 1960s and 1970s failed to produce an effective vaccine, they did lead to a recognition that the international quarantine requirements of the WHO for cholera vaccine were ineffective (Mosley, *et al.*, 1973). Consequently these requirements were eliminated, saving millions of people around the world the inconvenience, pain and cost of a useless procedure.

In terms of demonstrating the practical utility of oral rehydration therapy, the first large-scale hospital-based study was carried out in the Matlab treatment centre in 1968 while the first major investigation of alternative approaches to home-based therapy was tested in the field in the mid-1970s (Cash, *et al.*, 1970; Chen, *et al.*, 1980).

In the area of family planning, the Contraceptive Distribution Project and its successor, the Family Planning-Health Services Project initiated in 1977, provided conclusive documentation of the effectiveness of household distribution of contraceptives in impoverished populations (Phillips, *et al.*, 1982). At the same time, it demonstrated the standards of service delivery required to sustain a demographic impact (Simmons, Phillips, Rahman, 1984; Phillips, *et al.*, 1988).

The scientific contributions of the Matlab project to our understanding of the inter-relationships between biological and social factors in determining the levels of health and fertility in poor developing countries are inestimable.

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In the area of diarrhoeal diseases, field work in Matlab has expanded our knowledge tremendously of the multiple aetiologic agents of these diseases, the spectrum of illness they produce, the biological and social factors underpinning their transmission in households and communities, their consequences for survival, growth and development, and the relative effectiveness of alternative intervention strategies (Black, *et al.*, 1982a; Black, *et al.*, 1982b; Black, *et al.*, 1984a; Black, *et al.*, 1984b).

In the case of fertility, longitudinal studies in Matlab have provided detailed knowledge on the determinants of natural fertility and birth intervals including the biological and social factors related to breast feeding, lactational amenorrhoea, coital frequency, fecundity, and foetal wastage (Chowdhury and Becker, 1981; Huffman, *et al.*, 1987; Ford, *et al.*, 1989; John, *et al.*, 1987).

The maintenance of a demographic surveillance system for three decades has permitted an extraordinary range of studies that would otherwise have been practically impossible through any other approach. For example, studies in Matlab have documented the demographic impact of natural and man-made disasters including famine and war (Chen and Chowdhury, 1987; Razzaque, 1989; Bairagi, 1986).

High quality nutrition studies require knowledge of the exact chronological age of the study subjects which can only reliably be obtained through an ongoing registration system. The work in Matlab has not only contributed fundamentally to our knowledge of the determinants of growth of infants and children but more recently researchers have begun to look at the inter-relationships between adolescent growth, nutrition, menarche, and child bearing (Bairagi, 1986; Riley, Huffman, Chowdhury, 1989). The design of the demographic surveillance system permitting record linkage of vital events provides multiple opportunities for long-term cohort studies.

This system has been exploited to answer many questions including the inter-relationships between infant mortality and fertility, the social and economic determinants of child survival, the levels and determinants of maternal mortality, and the demographic impact of immunization programmes (Swenson, 1978; D'Souza and Bhuiya, 1982; Koenig, *et al.*, 1988; Koenig, *et al.*, 1989).

The Matlab DSS, with its data base, has also provided the opportunity for the development and validation of methodologies for demographic data collection (Chowdhury, 1977; Becker and Mahmud, 1984).

There is another important contribution of the Matlab project that should not be overlooked: its role in training scores of scientists in Bangladesh and around the world. This training has not only been in the field in Matlab but also through the availability of data from the DSS to many leading universities around the world.

This contribution to the development of a pool of scientists with critical skills in studying developing-country health and population problems is perhaps one of the most important contributions of the ICDDR,B in general and the Matlab project in particular. ■

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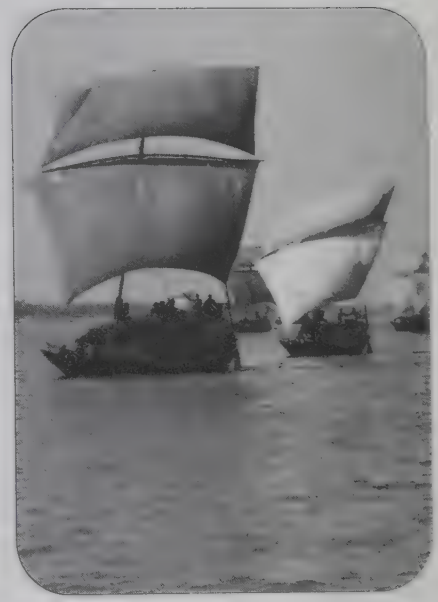
A welcome sight for children, this Matlab woman walks from village to village selling ice-cream from a makeshift ice-box.

Historical Perspective and Methodology

CHAPTER 4

Data Collection System and Datasets Available in Matlab

Vincent Fauveau



Demographic surveillance systems have been operating in many parts of the developed world for several decades. In contrast, there are very few of them in the developing world because they are difficult and costly to use and maintain.

Matlab, the field station of the International Centre for Diarrhoeal Disease Research, Bangladesh (ICDDR,B) has, perhaps, one of the largest demographic surveillance systems ever to be set up in a developing country and has been in operation since 1966, longer than any other.

The purpose of this chapter is to describe the data collection systems and the datasets in use in Matlab. The unique feature common to all studies conducted in Matlab is the use of an individual permanent identification number, thus allowing linkages between various databases and multiplying the potential for analysis in each study.

Initially the Matlab study area was selected by epidemiologists interested in carrying out cholera studies and cholera vaccine trials (see Chapter 3). To do so, they needed an area with a high prevalence of cholera, a high density of population, a dense network of rivers and canals to allow easy water communications, and an easy access to and from the capital Dhaka. All these conditions were met in Matlab, and there was the additional advantage of being able to use the census cards of the last smallpox eradication campaign in 1961.

The first cholera vaccine trial took place in 1963 in an area covering 23 villages, encompassing a population of 27,629 (Mosley, *et al.*, 1968).

The first census took place in 1966, and covered 132 villages, with a total population of 111,748. Soon after this census, the registration of births, deaths and migrations was instituted (Mosley, *et al.* 1970). The area under demographic surveillance was increased to 233 villages and 226,000 people in 1968, but the cost and the problems of maintaining the quality of this surveillance were so great that the area was contracted to 149 villages and 176,000 people in 1978. The current demographic surveillance system still covers the same area

Part I

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(Ruzicka & Chowdhury 1978), but by 1988 the population had reached 200,000 even though river erosion on the western side of the area has wiped away two villages during the floods of 1987 and 1988.

In 1978 the study area was divided into a treatment area (the 70 villages in grey on the map (Figure 1), and a comparison area (the 79 villages shown in a lighter grey on the map) of equal population size.

This division was made at the start of one of the most important studies undertaken in Matlab, the Family Planning-Health Services Project (FPHSP), which aimed at testing the effect of a community-based programme to increase contraceptive use and decrease fertility and mortality (Bhatia, *et al.* 1980). Its effect was to be assessed by comparing service use and demographic indicators between the treatment area and the neighbouring comparison area (D'Souza 1990).

The latter was only served by the Government of Bangladesh Health and Family Planning Programme, which had a less complete coverage and was generally under-utilised. Treatment of diarrhoeal diseases at the Matlab hospital was also offered to the comparison area population.

CONTINUED...

Data Collection... in Matlab

In Matlab there are 4 types of datasets collected which are now available for research purposes: the Demographic Surveillance System (DSS), the Record Keeping System (RKS) for mothers (RKS-M), the RKS for children (RKS-Ch) and the special studies. Table 1 (facing page) outlines their respective definition, functions, population covered and duration of operation.

The DSS, the oldest and the largest, is dubbed the "mother" dataset, because it covers the entire study population since 1966.

It assigns every individual living in the study area a unique identification number, which is kept from birth to death, and can

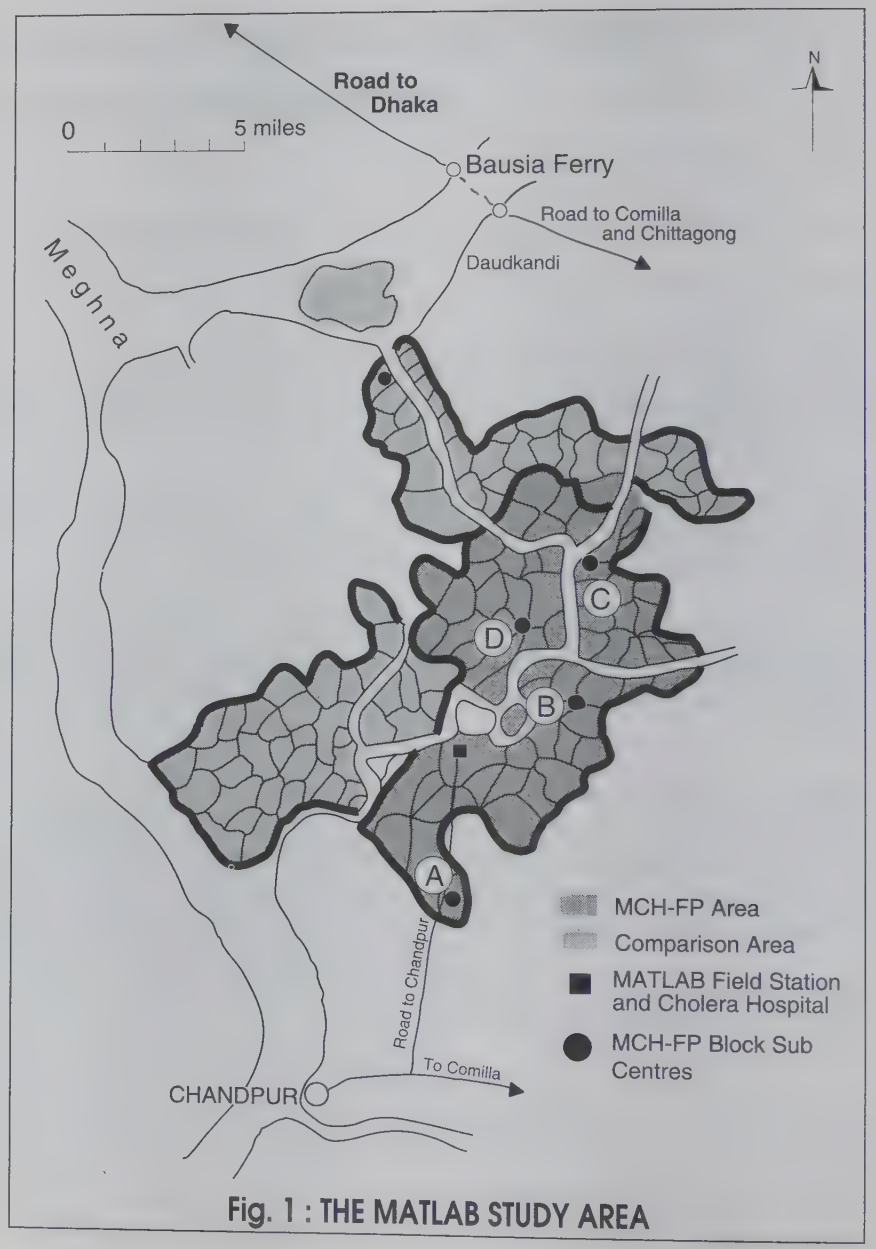


Fig. 1 : THE MATLAB STUDY AREA

be used by any other study, thus allowing linkages between all studies carried out in Matlab.

This identification (ID) number is made of 9 digits:

the first 3 indicate the village code (for example: V74),

the next 4 indicate the family number within this village (for example: 0283),

the final 2 indicate the individual number within this family (for example: 02).

Being a list of all individuals living in the area, the DSS had to be regularly updated by periodic censuses in order to record changes, correct errors and add socio-economic information.

The first censuses took place in 1966, 1968, 1974 and the last one was in 1982 (D'Souza, 1990).

The 1982 census also introduced a dual identification (ID) numbering system: the **RID, or permanent Registration** number, was assigned *once for everyone* and a **CID (Current ID** number) was set to designate present residence and would change with any change of address.

TABLE 1

The 4 datasets available in Matlab

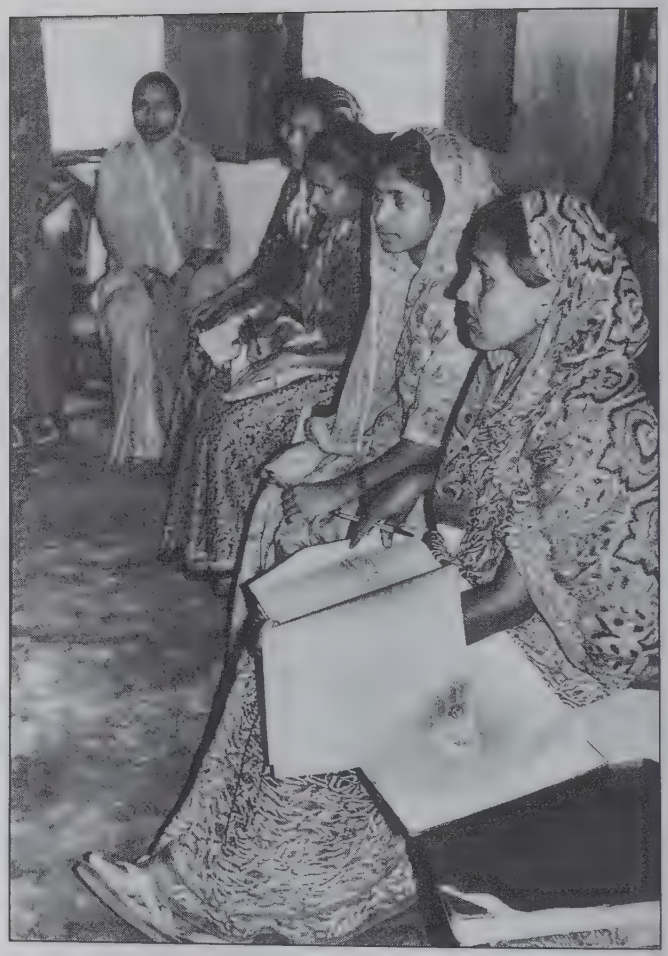
NAME:	DEMOGRAPHIC SURVEILLANCE SYSTEM (DSS)	RECORD KEEPING SYSTEM FOR MOTHERS (RKS-M)	RECORD KEEPING SYSTEM FOR CHILDREN (RKS-Ch)	SPECIAL STUDIES
FUNCTIONS:	Longitudinal Registration of vital events + Update of pop. census +Methodological studies	Longitudinal Registration of reproductive status and morbidity +Service recording +Feed-back services +Production of Service Record Books	Longitudinal Registration of morbidity +Service recording +Feed-back services +Production of Service Record Books	Occasional Data collection of morbidity or other info.
POPULATION:	200,000 (1988) in 147 villages (whole study area)	16,000 married women of reproductive age in 70 villages	18,000 children under 5 years in 70 villages	variable
DURATION :	since 1966	since 1978	since 1986	

CONTINUED...

Data Collection... in Matlab

The Matlab Demographic Surveillance System main office. All information concerning families is kept in the volumes (one volume per village) and is regularly updated.

Demographic Surveillance System workers review the family registers at the occasion of a field visit.



Bi-weekly updating of the Record Keeping System by the community health workers in one of the sub-centres (here in Torkey, Block C)

The RID has 10 digits, the first digit being "1" if the individual was born before 1982 and had the same RID and CID, or "2" if the individual was born after 1982 and might have different RID and CID.

As an example, a child who was born in 1983 in village V74 but who subsequently moved with his mother to live in another village, D12, carries a permanent RID of "2 V74 0283 03" and a CID of "D12 0054 03". We will now discuss the details of each of these 4 datasets:

1. THE DEMOGRAPHIC SURVEILLANCE SYSTEM

1.1. DEFINITION AND FUNCTIONS

The DSS has four functions: First the registration of "vital events"; live-births and other types of pregnancy terminations (still-births, miscarriages), deaths, marriages (and marriage dissolutions), and migrations (both in and out of the area).

The *second* function is to maintain and update the census of the 200,000 individuals living in the whole study area. This is done regularly, by keeping note of the changes in current events, and periodically at the time of a general census.

The *third* function is to provide information for scientists interested in doing their research in Matlab. This takes the form of the DSS Annual Report describing population structure and processed data, such as life-tables, or the provision of population figures along with particular information requested by individual scientists.

Finally, the *fourth* function of the DSS is to conduct its own research. This research focuses in two directions; the demography of a rural Bangladeshi population and demographic methodologies. The latter includes methods for conducting surveys, for data management and for lay reporting of the cause of death, among others.

One important feature of the system is the reporting of accurate age, to the day, at least for the individuals who have been born in the study area since 1966, who include the great majority of the people aged less than 25 years.

1.2. Field work

In the MCH-FP or treatment area, eighty female Community Health Workers (CHWs) visit each household in their own village fortnightly.

In the comparison area, thirty CHWs visit each household monthly. This difference in frequency of visits is due to different workloads in each area, the CHWs of the MCH-FP area having additional duties (see below). During home visits, the CHWs enquire about vital events that have occurred in the household since their last visit, and record them in their notebooks.

In each household they find a Family Register, which they update manually by entering changes in the family composition. A copy of all family registers, compiled and bound by each village, is kept in the main office in Matlab. (See sample overleaf.)

CHWs meet their supervisors (16 male health assistants) in the field twice in a month to transmit the information collected. Then together they visit the households where vital events have been reported to interview family members and fill up event forms with detailed information.

CONTINUED...
Data Collection... in Matlab

There is a distinct event form for pregnancy outcome, death, marriage, in-migration, and out-migration.

Samples of birth forms and death forms are shown in Figures 3 and 4 (overleaf). The method for analysing death-related information and assessing the cause of death is described in detail in Chapter 5.

UPDATE DATE 30/06/82

INTERNATIONAL CENTRE FOR DIARRHOEAL DISEASE RESEARCH, BANGLADESH
DEMOGRAPHIC SURVEILLANCE SYSTEM : MATLAB
FAMILY REGISTRATION BOOK

VILLAGE: 86 NAME: SARKERPARA BARI : 014 NAME: NURUDDIN FAM-RES-NO: SIZE: 12 RELGN: MUSLIM

IIND NO.	NAME	SEX	RELGN HHH	MOTHER'S REGN. NO.	MAR STA	SPOUSE'S REGN. NO.	ENT YR	MEMBER'S REGD. NO.	DATE OF BIRTH	EDUCATION TYPE	EDUCATION YRS	OCCUPATION PRIMARY	OCCUPATION SECONDARY	REMARKS
01	NURUDDIN	M	HEAD	1V58014607	M	1V58014601	74	1V58014601	0/00/25	SEC	7	MIL.WRKR	FARMER	
02.	APEL BEGUM	F	WIFE		M	1V58014602	74	1V58014602	0/00/35	MAK		H-WIFE	NO. OCCUPN	
03.	MONIR UDDIN (BADAL)	M	SON	1V58014602	N		74	1V58014603	0/00/63	SEC	9	STUDENT	NO. OCCUPN	
04.	AMENA (DIPU)	F	DAUG	1V58014602	N		74	1V58014605	0/00/66	SEC	4	STUDENT	NO. OCCUPN	
05.	WAZEDA	F	DAUG	1V58014602	N		74	1V58014606	19/04/69	SEC	1	STUDENT	NO. OCCUPN	
06.	A. BAKER	M	SON	1V58014602	M	1V58014609	74	1V58014608	0/00/54	SEC	10	EST.BUSN	FARMER	
07.	MOMINUNNESA	F	MOTH		W		74	1V58014607	0/00/08	MAK		H-WIFE	NO. OCCUPN	
08.	ZULEKHA	F	DA. L		M	1V58014608	74	1V58014609	0/00/57	SEC	4	H-WIFE	NO. OCCUPN	
09.	NAHIDA	F	G. DA	1V58014609	N		74	1V58014610	12/05/73	SEC	1	STUDENT	NO. OCCUPN	
10.	ALAM (KACCHI MIA)	M	G. SO	1V58014609	N		75	1V58014640	18/06/75	NO		NO. OCCUPN	NO. OCCUPN	
11.	MORZINA	F	G. DA	1V58014609	N		77	1V58014641	30/09/77	NO		NO. OCCUPN	NO. OCCUPN	
12.	FAZAL	M	G. SO	1V58014609	N		79	1V58014640	29/11/79	NO		NO. OCCUPN	NO. OCCUPN	

Fig 2 : Sample page, Family Registration Book

CONTINUED...
Data Collection... in Matlab

Supervisors and managers meet once a month in the central office in Matlab to exchange directives, ensure continuous training and perform administrative tasks. Senior health assistants perform regular supervisory field visits to look for errors or missing events, and to ensure the target population's cooperation.

This cooperation results from a long and patient personal relationship developed by all field workers with all the other residents of their village. One of the criteria for the selection of these field workers is that they reside in their assigned village.

1.3. Data management

Before 1989, all registration forms were taken to the headquarters in Dhaka to be checked manually and entered into event files.

Since 1989, this information is entered directly into the personal computer in the Matlab DSS office, which has a system of automatic detection for errors and inconsistencies.

Changes in family composition are also entered manually into the census volumes kept village by village in the main office. Diskettes are transferred to the Mainframe computer in Dhaka for storage in event files (the death file, birth file, and so on) and the census files. The former are used to calculate numerators for demographic rates, and the latter to compute mid-year populations for denominators.

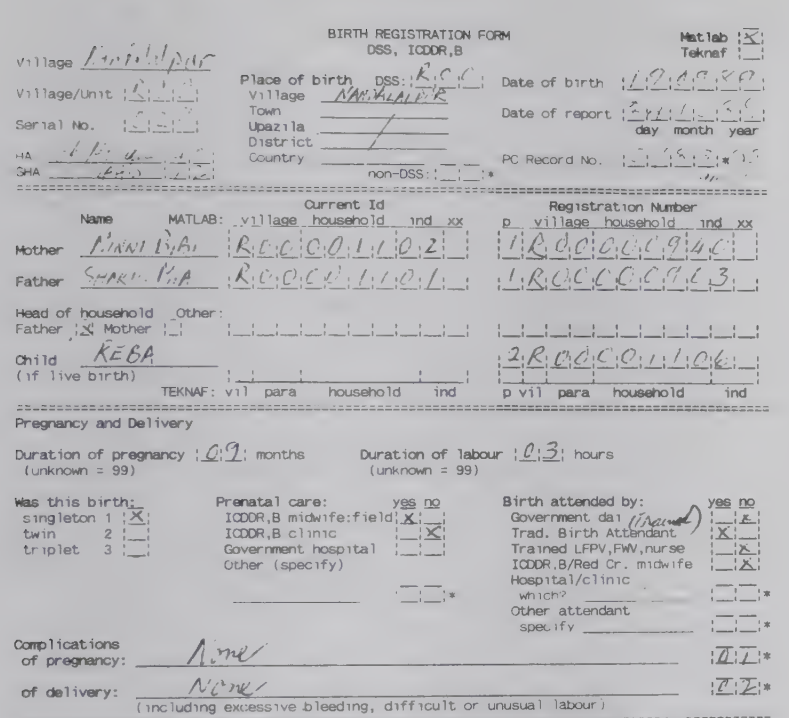
A copy of basic rates and trends is shown overleaf in Table 2, overleaf (taken from ICDDR,B Annual Report 1991). Demographic tabulations from 1974 to 1986 can be found in the annual DSS-Matlab Scientific Reports listed in the reference section.

2. THE RECORD KEEPING SYSTEM (RKS)

2.1. Functions

The RKS applies only to the treatment or MCH-FP area. It has four functions, which are common to the RKS-Mothers dataset

Fig 3



BIRTH REGISTRATION FORM
DSS, ICDDR,B

Matlab [X]
Teknaf [ ]

Village: Kanchalpur
Village/Unit: 5
Serial No.: 5
HA: [illegible]
SHA: [illegible]

Place of birth DSS: R.C.C.
Village: NAWAPARA
Town:
Upazila:
District:
Country:
non-DSS: *

Date of birth: 10/4/90
Date of report: 2nd / 5 / 90 (day month year)
PC Record No.: 5 5 *

	Name	MATLAB: village	household	ind	xx	Registration Number: p	village	household	ind	xx
Mother	PANNI BAI	R.C.C.	0.1	1	0.2	1	R.C.C.	C.C.9	4.C	
Father	SHARU MIA	R.C.C.	1.1	0.1		1	R.C.C.	C.C.A	3	
Head of household: Father [ ] Mother [X]	Other:									
Child (if live birth)	KEBA					2	R.C.C.	0.1	1.0.6	

TEKNAF: vil para household ind | p vil para household ind

Pregnancy and Delivery

Duration of pregnancy (unknown = 99): 09 months
Duration of labour (unknown = 99): 03 hours

Was this birth: singleton 1 [X], twin 2 [ ], triplet 3 [ ]

Prenatal care: yes / no
ICDDR,B midwife:field [X]
ICDDR,B clinic [ ] [X]
Government hospital [ ]
Other (specify) [ ] *

Birth attended by: yes / no
Government dai (Record) [ ]
Trad. Birth Attendant [X]
Trained LFPV,FWV,nurse [ ]
ICDDR,B/Red Cr. midwife [X]
Hospital/clinic which? [ ] *
Other attendant specify [ ] *

Complications of pregnancy: None [ ] *
of delivery: None [ ] *
(including excessive bleeding, difficult or unusual labour)

If multiple birth, this child is the: 1st twin 1 [ ], 2nd twin 2 [ ]; 1st triplet 1 [ ], 2nd triplet 2 [ ], 3d triplet 3 [ ]
n/a

At birth baby: yes / no — cried, breathed, had pulse, moved (on own) — one or more "yes"?

Live birth 1 [X]
Still birth (7+ months) 2 [ ]
Miscarriage (spontaneous) 3 [ ] <-- duration less
Miscarriage (induced) 4 [ ] <-- than 7 months
method used to induce [ ] *

This section for LIVE BIRTHS ONLY

Relationship of child to head of household: Daughter [ ] [ ] [3] *

Sex: male 1 [ ], female 2 [X], unknown 3 [ ]

Presentation: head 1 [X], face 2 [ ], breech 3 [ ], limb 4 [ ], unknown 5 [ ]

Crying induced? spontaneous 1 [X], unknown 2 [ ], induced(specify) [ ] [ ] *

Cord cut by (one only): Safe Delivery Kit SDK 1 [X], other new/boiled blade 2 [ ], other blade 3 [ ], bamboo split 4 [ ], hospital methods 5 [ ], other (specify) [ ] [ ] *

Cord dressing: yes / no
tied with thread [X]
ashes of anything [ ] [X]
unburnt dung [ ] [X]
dettol [X] [ ]
jantion violet [ ] [X]
other (specify) [ ] [ ] *

Complications of baby: None [ ] [ ] [0] *

Date entered: Field volume 24 / 1 / 91; Office volume [illegible]

Remarks [ ] *

Fig 4

DEATH REGISTRATION FORM
DSS, ICDDR,B

PC No. [ ] [ ] [ ] [ ] *

Village [ ] [ ] [ ]
Serial No. [ ] [ ] [ ]

Place of death DSS: [ ] [ ] [ ]
Village
Town/Union
Thana
District
Country [ ] [ ] [ ] [ ] * non-DSS

Date of death: [ ] [ ] / [ ] [ ] / [ ] [ ] (day month year)

Name [ ]

	Current Id: village	household	ind	Registration Number: p	village	household	ind

Date of birth [ ] [ ] / [ ] [ ] / [ ] [ ] (day month year)

Sex: Male 1 [ ], Female 2 [ ], Unknown 3 [ ]

Which were consulted? and which was first, second, etc? (1,2,3,max.9):

Allopath registered [ ]
Hospital inpatient [ ]
Hospital outpatient [ ]
Allopath quack [ ]
Homeopath [ ]
Kabiraj [ ]
Dai, TBA [ ]
Trained midwife [ ]
Spiritual [ ]
None [ ]
Other (specify) [ ]

Description of events and symptoms leading to death: [ ]

Cause of death: [ ]

Type: non-maternal 0 [ ], during pregnancy 1 [ ], delivery & after 2 [ ] (within 42 days)
Code: [ ] [ ] *

Coded by [ ] [ ] * Reviewed by [ ] [ ] *

Remarks: [ ] [ ] *

HA [ ] [ ] [ ]
SHA [ ] [ ] [ ]

Date: Report [ ] [ ] / [ ] [ ] / [ ] [ ]
Field
Office [ ] [ ] / [illegible] (day month year)

Table 2 : Population dynamics in the Matlab Treatment Area, in the Matlab Comparison Area and in Teknaf, from 1978-1990. The Matlab Treatment Area is served by the Centre's MCH-FP Programme while the Comparison Area is served by the government health services alone.

Vital rates (per 1000 people	Area	1978	1979	1980	1981	1982	1983	1984	1984	1986	1987	1988	1989	1990
ALL DEATHS*	Treatment Area	12.5	12.1	11.3	11.9	12.5	12.1	13.4	10.1	9.9	9.4	8.7	8.1	7.6
	Comparison Area	13.8	15.6	14.8	14.4	15.9	18.0	17.3	14.2	12.1	11.1	11.1	9.4	9.4
	Teknaf	14.7	15.9	12.8	14.2	13.3	14.7	17.1	12.8	13.4	17.0	-	-	-
NEONATAL DEATHS[a]	Treatment Area	69.0	70.9	59.3	66.4	58.1	56.4	57.9	51.8	49.6	43.5	43.0	47.0	48.0
	Comparison Area	78.7	74.6	72.7	69.5	68.1	70.3	71.4	69.5	51.8	55.2	57.2	51.5	55.7
	Teknaf	78.8	85.6	75.0	88.2	72.8	88.4	96.0	77.5	81.0	83.8	-	-	-
POST NEONATAL DEATHS[a]	Treatment Area	45.5	43.5	32.6	36.1	47.5	41.8	56.9	34.2	37.5	34.9	38.9	28.7	27.2
	Comparison Area	47.0	43.3	41.3	45.0	50.2	42.2	55.7	49.0	37.7	39.2	39.8	38.2	35.5
	Teknaf	54.3	57.1	46.8	51.2	46.1	65.4	56.4	45.9	46.2	57.3	-	-	-
CHILD (1-4 YRS) DEATHS	Treatment Area	22.5	17.1	18.6	19.1	18.8	21.9	23.1	16.0	13.1	9.8	7.4	6.4	5.3
	Comparison Area	22.1	26.2	25.4	24.8	27.4	35.3	39.2	24.6	20.1	14.9	14.3	11.3	9.2
	Teknaf	16.1	16.9	13.7	14.9	10.5	12.3	22.1	11.9	12.5	21.6	-	-	-
BIRTHS*	Treatment Area	32.1	34.9	37.1	35.3	36.9	33.8	30.7	34.4	33.3	33.5	30.9	28.5	28.1
	Comparison Area	37.7	47.0	45.5	43.8	44.7	42.4	37.3	42.6	40.0	39.1	40.5	36.5	36.1
	Teknaf	45.1	55.6	52.4	51.5	53.2	53.4	54.8	54.4	55.5	57.5	-	-	-
TOTAL FERTILITY RATE[b]	Treatment Area	4.5	4.9	5.1	4.8	5.0	4.5	4.0	4.5	4.3	4.1	3.7	3.7	3.6
	Comparison Area	5.5	6.9	6.7	6.3	6.3	6.1	5.1	6.0	5.5	5.2	5.4	5.2	5.2
	Teknaf	6.7	8.1	8.1	7.7	7.9	7.5	7.8	8.1	8.1	8.6	-	-	-
NATURAL INCREASE	Treatment Area	19.6	22.9	25.8	23.4	24.3	22.3	17.3	24.3	23.4	24.1	22.2	20.4	20.5
	Comparison Area	23.9	31.4	30.6	29.4	28.8	25.8	20.0	28.4	27.9	28.0	28.0	27.1	26.7
	Teknaf	30.4	39.7	39.6	37.3	39.9	38.7	37.7	41.8	42.1	40.5	-	-	-

** per 1,000 population [a] per 1000 live- births [b] per woman - = Figure not available*

and the RKS-Children dataset. Since most features of these 2 datasets are common, they are described together.

The first function of the RKS is to register reproductive events, including menstrual status, lactational status, contraceptive use and morbidity events for all eligible women, as well as all morbidity events and nutritional status for all children aged less than 5 years in the treatment area. This covers about 16,000 eligible women, defined as living in one of the treatment area villages and currently married and in their reproductive age (up to menopause), and about 18,000 children aged less than five years. All children aged less than five years living in one of the treatment area villages are eligible, even if their mother is absent, dead, has migrated out, or has lost her eligibility status.

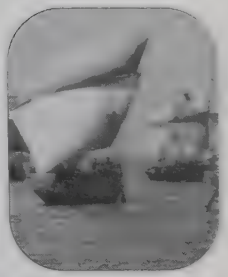
The RKS-Mothers file has been continuous since the start of the Family Planning-Health Services Project (FPHSP) in October 1977, and the RKS-Children's file has been added since January 1986.

The second function of the RKS is to record all services provided to eligible mothers and children. This includes not only contraceptive methods, oral rehydration salts (ORS) packets, essential drugs, immunization, nutrition supplements, but also anthropometric measures and referrals to the MCH-FP clinics in the subcentres or in Matlab.

The third function of the RKS, related to the second one but developed more recently (since 1989), is to give feedback, with computed information related to the coverage and use of services offered, to service providers, including the field workers, supervisors and managers.

For example, special computer programmes can produce monthly lists of pregnant women with their gestational age, lists of unimmunized children, lists of supplies needed, or computed performance indicators, such as contraceptive use rates by workers, or immunization coverage rates.

Finally, the fourth function of the RKS is to produce the Service Record Books (SRBs) used by the field workers. Up till 1988 these books were issued annually, but since 1989 they have been issued every 18 months to save time and money. A table of contents for these books is reproduced in Figure 5 (overleaf). The core part is the section on individual mothers and children, as seen in Figure 6 (overleaf). It is updated with the latest information available before it is printed.



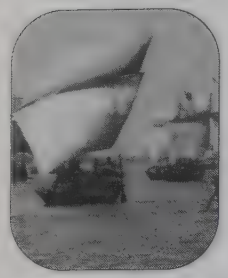
Households are sorted in the books according to a geographical pattern that requires the least amount of effort to retrieve the correct mother during the visitation rounds. A refinement was made in 1990 when it was decided that each mother's section on the Service Record Book was to be followed by a section for each of her children plus a blank space to enter one potential additional child (except for sterilized women).

2.2. Field work

Eighty female Community Health Workers (CHWs) visit each household of their own village fortnightly. These CHWs are the same ones who perform the DSS registration. The density of workers within the population is higher in the treatment area than in the comparison area because their duties are more time-consuming in the treatment area.

Each CHW is responsible for an average of 200 households, and they visit 20 households per working day. During the first visit of the month, they enquire about the mothers, their menstrual status, contraceptive use, contraceptive side-effects, pregnancy and incidence of disease since the last visit. They provide contraceptives and basic medicines as needed, and refer patients with complications to one of the 4 subcentre clinics staffed by paramedics. They carry their computer-printed Service Record Book, in which they note, in a coded format, all changes regarding the information described above (Figure 6).During the second visit

CONTINUED...
Data Collection... in Matlab



of the month, CHWs enquire about the children (and also about those mothers who were absent during the preceding visit). They note morbidity events (diarrhoea, acute respiratory infection, measles), measure nutritional status (mid-upper-arm circumference (MUAC) and tibial oedema), provide vaccines and essential drugs, and refer severely affected children to the subcentres or Matlab. *CHWs meet their supervisors, programme managers and supervising physicians twice a month* in the subcentres to receive directives, ensure continuous training and perform administrative tasks. A group of coders also joins these meetings and they transfer the information from the SRBs to coding sheets. The CHWs are never separated from their books.

Fig 5 : CONTENTS
COMMUNITY HEALTH WORKER
SERVICE RECORD BOOK (SRB)
(MAR 1898 - JUN 1990)

SL.	SUBJECT	PAGE
	COMMUNITY HEALTH WORKER WORKING PROGRAM	I
	COMMUNITY HEALTH WORKER WORKING UNIT	II
	COMMUNITY HEALTH WORKER ACTIVITY HISTORY	III
01.	ELIGIBLE WOMEN SERVICE RECORD	001
02.	SUMMARY OF CHANGES IN ELIGIBILITY STATUS	301
03.	DEPO-PROVERA INJECTION	311
04.	ORAL PILL (HIGH DOSE)	331
05.	ORAL PILL (LOW DOSE)	341
06.	CONDOM	351
07.	VASECTOMY	361
08.	IUD	371
09.	TUBECTOMY	381
10.	FOAM	391
11.	OTHERS	401
12.	LIST OF BARI MOTHERS	411
13.	DIARRHOEAL INCIDENCE REPORT BY *BARI* MOTHERS	421
14.	LIST OF TRADITIONAL BIRTH ATTENDANTS (TBAs)	431
15.	PNEUMONIA MANAGEMENT AND FOLLOW UP	441
16.	DEATH	451
17.	DSS RECORD	461
18.	SUPPLY	471
19.	SUMMARY PAGE OF WORK PROGRESS	481
20.	EPI COVERAGE	491
21.	SUPERVISORY VISITATION	501
22.	TT RECORD OF ADOLESCENT (UNMARRIED) WOMEN	511

CONTINUED...

Data Collection... in Matlab

2.3. Data management

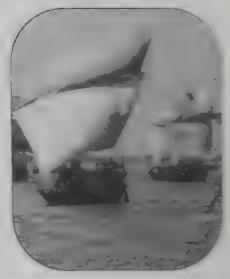
Since 1989 in Matlab, the RKS data are entered directly onto diskettes, using a system which automatically checks for errors and inconsistencies. Feedback information is also produced in the Matlab

Fig 6 : ELIGIBLE WOMEN AND CHILDREN UNDER 5 YRS SERVICE RECORD*

	BLOCK:		1990							1991												
HSL : REL : EDU :	HH AREA :	VISIT DATE	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
MCID : MRID : NAME : DOB : / / AGE :	TT DATE: 01. / / 02. / / 03. / / 04. / /	REPROD. STAT																				
TPG : CEB : LCH :		LACTATION																				
LSN : ENTDT : / / ELDT : / / ELR :		CONTRACEPTION																				
LMPDT : / / EDDT : / / PODT : / / POS:	ADD.CH.DSR:YL	HUSBAND ABS.																				
S.KIT USED: Y / N BIRTH ATTND:	FP.HIST: /	SUPPLEMENT.																				
		MORBIDITY																				
		REFERRALS																				
		REASON SWT/DROP: SIDE EFFECT MGMT.																				

CSL :	BCG : / /	VISIT DATE	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
CCID : CRID : NAME : MRID :	DPTP1 : / / 2. / / 3. / / 4. / /	DIAR. 2 WKS/TYPE																			
NAME :		DIAR. MGMT.																			
DOB : / / SEX : BOR: LIT:	MEAS DUE: / /	PNEU.LAST 1 MON.																			
ENTRY TYPE : ENTRY DATE : / / CHEST (MM) :	MEAS VAC : VITAMIN A : 1. / / 2. / / 3. / /	PMEU. MGMT.																			
ELDT : / / ELR :		ARM CIR/T.OEDEMA																			
		FEEDING PRACT.																			
		MORBIDITY																			
		REFERRALS																			

*Shown here at 50% of actual size



office. Data are then transferred on diskettes to the headquarters in Dhaka, to be merged and stored in relational databases.

There is a main mothers' file, which traces as many as 28,000 women (as of 1990), some of them since 1978 (that is 160 months). These women have experienced 52,000 pregnancies since 1978 and have given birth to about 43,000 live babies. The main children's file runs from 1986. Baseline information is entered once and for all when somebody becomes eligible (through birth, immigration, or marriage), and changes are entered only when they are reported by the field and after they have been checked. Termination of an observation is by loss of eligibility namely by death, emigration, reaching five years of age or menopause.

In the future, this RKS will be a suitable system to experiment with field-based direct data entry onto portable mini-computers. These mini-computers would be hooked up once a month to a portable data-collector and data would then be transferred to the main office to update the files.

3. THE SPECIAL STUDIES

The third source of data available in Matlab is the group of special studies. Special studies cover a broad range of topics. They started with the cholera vaccine field-trials of 1963 (Mosley, *et al.*, 1968) and 1966 (Mosley, *et al.*, 1969), followed by the one of 1968 (Mosley, *et al.*, 1970). The field trials for which data are potentially available are the ones of 1974, involving 93,000 participants (Curlin, *et al.*, 1978), and the last trial of 1985, involving 63,000 women and children with a four-year surveillance (Clemens, *et al.*, 1986).

The common feature of all these special studies (at least those since 1974) is the use of a DSS identification number which allows linkages with any other dataset.

Examples of recent special studies, each requiring their own special data collection and management, include:

the Vitamin A Capsule Distribution Study (from June 1986 to December 1990),

the Acute Respiratory Infections Study (from December 1988 to 1990),

the Maternity Care Study (from April 1987 to 1990),

the Nutrition Surveillance Study (from June 1987) and

the Measles Surveillance Study (from December 1989).

All these studies are described in detail in their respective sections in this report.

An example of how these special studies can be linked to current DSS or RKS files is provided by the study of long-term protection against death from neonatal tetanus provided by maternal immunization with one or two doses of tetanus toxoid.

The 1974 cholera vaccine trial, following a double-blind placebo design, administered one or two doses of tetanus toxoid to women in the placebo group (Curlin, *et al.*, 1978). This made it possible, 16 years later, to analyse the effect of this immunization on early neonatal mortality among tetanus-immunized women as compared with cholera-immunized women (Koenig, *et al.*, 1991).

Another special study was the Determinants of Natural Fertility Study (DNFS), involving monthly recording of menstruation in a cohort of 2,500 women from 1975 to 1978 (Chowdhury & Becker, 1981). The same women were studied in the Birth-Interval Dynamics Study (Ford, *et al.*, 1989), and a sub-sample of 1,600 of these women, who were aged 10 to 20 years during this initial study, was then re-examined 10 years after to study age at menarche and post-menarcheal growth in relation to biological and socio-economic factors (Riley, *et al.*, in preparation).

Most special studies use lists of cases or cohorts provided by the DSS and DSS-generated lists of controls, matched or unmatched, and then link them to other specially collected data.

■

CONTINUED
Data Collection... in Matlab

CHAPTER 4

Data Collection System and Datasets Available in Matlab

Vincent Fauveau

Lessons learned...

Demographic events are best recorded if households are visited twice monthly.

To minimise the number of missed or unreported events, it is crucial that field workers are residents of the village under their responsibility.

The key to obtaining consistently accurate information during a routine procedure, such as registration of demographic events, is good management, including recognised leadership, constant supervision and job satisfaction.

If carefully planned, it is possible to insert special studies, including special data collection, into the routine work of demographic workers.

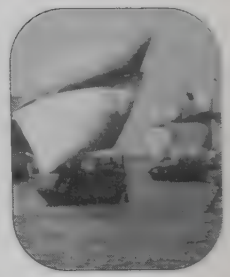
Cross-sectional linkages and longitudinal surveillances are made possible by the use of a unique individual registration number.

Demographic and epidemiological studies often include family studies and village studies. Therefore systems should be developed to allow family linkages. (For example linking all the offspring of a mother.)

For impact evaluation studies, health and family planning services received by individuals must be recorded. For programme performance studies, services provided must be recorded.

Good management of service programmes includes rapid feedback to workers for quick adjustments.

Services and surveillance are best recorded in 1 single book kept by the worker rather than on many separate sheets of paper or cards.



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Data Collection... in Matlab

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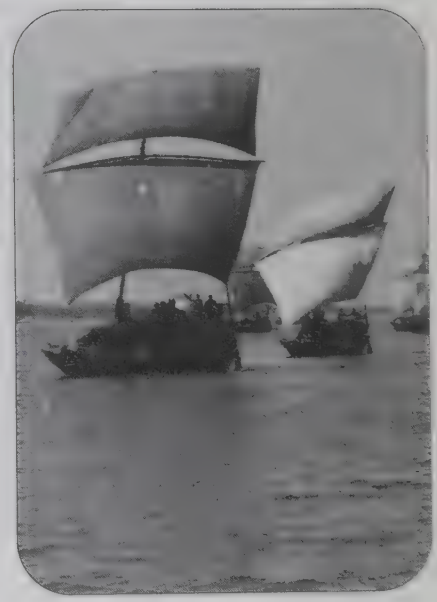
Data Collection... in Matlab

A wealth of information rests on these shelves at the DSS main office.

CHAPTER 5

Assessment of Cause of Death in the Matlab Demographic Surveillance System

Vincent Fauveau
Bogdan Wojtyniak
Hafizur Rahman Chowdhury
Abdul Majid Sarder



The documentation of causes of death has contributed to the progress of knowledge in epidemiology and public health (Hakulinen, *et al.*, 1986; Ewbank, 1984; Lopez, 1990). It allows assessment of the health status of a population, assignment of health priorities, study of time-trends of mortality from specific causes, and evaluation of health interventions. Such documentation is common practice in developed countries where most deaths occur in a medical environment and post-mortem autopsies are both feasible and culturally acceptable.

In developing countries, however, most deaths occur in the home with limited or no medical attendance, and post-mortem autopsies are rarely possible. The assessment of cause of death must rely on an alternative source of information namely the description of symptoms and events preceding death by relatives who have attended the event.

The idea of assessing the cause of death through an analysis of symptoms and events collected by lay reporters was introduced by Biraud in the 1950s (1956). It was later formalized with the production of the first list of causes of death to be used through lay reporting of symptoms preceding death (WHO, 1978). The term "verbal autopsy", first proposed in Narangwal (Kielmann, *et al.*, 1983), refers to a method of retrospective interview with individuals who have attended a death and can describe what happened during the few hours, days or months preceding death. A most likely cause of death is then inferred from the sequence and the combination of symptoms and events reported.

Verbal autopsies have been used in a few primary health care projects concerned with research and evaluation of health services in **India** (Kielmann, *et al.*, 1983), in **Bangladesh** (Chowdhury, *et al.*, 1980; Chen, *et al.*, 1980; Islam, *et al.* , 1982; Zimicki, 1986), in **South America** (Puffer & Serrano, 1973; Mata, 1978), in **Senegal** (Garenne & Fontaine, 1986), in **Kenya** (Omandi-Odhiambo, *et al.*, 1984), and in **The Gambia** (Alonso, *et al.*, 1987).

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Part I

The purpose of this chapter is to present detailed documentation on the modified methods to assess cause of death introduced in 1986 in Matlab, one of the field research areas of the International Centre for Diarrhoeal Disease Research, Bangladesh (ICDDR,B).

The basic methods used to detect vital events and to assess the cause of death prior to 1986 in the Matlab Demographic Surveillance System (DSS) have been described in the pioneering publications of Ruzicka & Chowdhury (1978), D'Souza (1985), and Zimicki, *et al.* (1985). From 1982 to 1983, a study was conducted by Bhatia (1989), based on improved methods to assess the causes of infant deaths, but these improved methods were not formally incorporated in the regular DSS procedures.

1. METHODS

1.1. Study area and background information

In 1963, the Cholera Research Laboratory, involved in epidemiological studies of diarrhoea and cholera vaccines, established its field station in Matlab, a rural subdistrict 50 km southeast of the capital, Dhaka.

Population counts were required for those studies and the first demographic surveillance system was established in 1966, combining periodic censuses and longitudinal registration of births, deaths, migrations (since 1966), and marriages (since 1975).

The study area, initially covering a population of 260,000, was reduced in 1978 to 175,000, distributed throughout 149 villages. It is located in a low-lying deltaic region, regularly flooded, with little infrastructure and poor communications, mostly by waterways.

In 1986, the total population under surveillance was 188,000, population density was approximately 750 per sq. km, total fertility 6 per woman, and infant mortality 98 per 1,000 live-births.

CONTINUED...
Assessment of Cause of Death

Since 1977 one half of the area under surveillance was covered by a Maternal and Child Health-Family Planning (MCH-FP) Project by the ICDDR,B, while the other half was covered by the Government of Bangladesh health services only (see map in Figure 1, Chapter 4, page 52)

Under the DSS, 110 female community health workers (CHWs), literate married women mostly from influential families, visited each household of their village fortnightly to record vital events. Living in the village and having a limited population to survey (1,000 to 3,000), they were unlikely to miss events.

They reported these vital events to their male supervisors (health assistants), and within an average of six weeks (two to ten), accompanied them to the houses where the events were detected.

During these visits, they interviewed relatives and the male health assistant completed forms with details of the events. There were specific forms for births, deaths, migrations and marriages. All of them contain village, family and individual identification codes as well as socio-demographic information, such as date of birth, date of the event, sex, place, doctor consulted, details of the event. Annexes 1 to 3 at the end of this chapter show samples of old and new death forms.

1.2. Lay reporting of information concerning deaths

The frequency of field visits to detect vital events and supervisory procedures in the demographic surveillance have remained unchanged since 1978.

The training of field staff and the structure of death forms, however, were modified in 1986, to give more importance to the description of symptoms and events preceding death. A large portion of the guidelines used to train field staff was borrowed from the study conducted by S. Bhatia (1989).

Of the 16 male health assistants and their 10 supervisors (senior health assistants) in charge of interviewing families and filling in death forms, only two had actually received formal health training prior to joining the project. Prior to 1986, they were allowed, and encouraged, to propose their own diagnosis of the cause of death, taking into account their individual background experience, and there was no system to check this diagnosis.

Space for writing symptoms was limited to three lines on the death form, and most of the time only a few significant words were written. In uncertain cases, the description was longer, but unstructured and biased with personal interpretation, and scattered with sometimes inappropriate medical terms. Writing was mostly in English, with many inaccurate, redundant or meaningless expressions.

These staff were retrained during two initial sessions at the beginning of 1986, followed by refresher sessions once a year. The training focused on the need to accumulate relevant information, as precise as possible, on timing, duration and gradation of each of the symptoms preceding death.

Although lists of relevant questions were proposed during the training, adapted to the particular age and/or sex group of the deceased person, health assistants were not encouraged to apply all questions in all cases, but rather to use judgement and concentrate on logical sequences. Only after exhausting a particular logical sequence were they instructed to change the subject and ask complementary questions.

Interviews were in colloquial Bengali, and interviewers were asked to write descriptive statements in Bengali, preserving local idioms and refraining from approximate translations. The space left for writing was increased from three to twelve lines, and additional space was provided on the back of the forms if needed.

A sample of a revised death form, completed by a health assistant, is shown in Annex 3. Written instructions to health assistants are detailed in Fauveau, *et al.* (1991b).

1.3. Interpretation of cause of death

Another change in the design of death forms was the removal of the list of codes for cause of death. This list, previously present, could have biased the diagnosis by "forcing" it into a fixed set of choices.

Instead, health assistants were asked not to indicate their own diagnosis. They were also asked not to write the age at death as calculated in order to reduce the risk of miscalculations. Exact ages were calculated and checked later during computer data entry.

Death forms, once completed in the field, were taken to the central office and read by medically-trained staff. During the first year of the modified procedure, 1986, each death form for children aged less than five years was reviewed by a panel of three physicians randomly selected from a list of ten physicians involved in health projects in Matlab.

Each of these physicians was experienced in the local health terminology. They were asked to make a diagnosis based on the available information, or to return the forms with requests for additional information if it was felt impossible to make a diagnosis with reasonable confidence. Diagnoses were to be written in full, with primary and underlying causes if necessary, on separate forms.

On reviewing these forms, medical diagnoses were compared and majority rules were applied, so if three or at least two physicians agreed, their diagnosis was retained.

If the three disagreed, death forms were returned to the field workers for supplementary information as requested, and then reinserted into the system.

CONTINUED...
Assessment of Cause of Death

This initial procedure involving physicians was found time-consuming and difficult to sustain as a routine. It was, therefore, replaced after the first year by a simpler and more sustainable one: interpretation of cause-of-death information was assigned to a medical assistant who had been recruited and trained for this purpose. (The selected candidates had three years of formal medical training and three years of practical experience in rural areas).

Involved in assigning primary and underlying causes of death full-time, this medical assistant also had to go to the field to collect additional information when required, and to code the cause of death. Instructions for coding are detailed in Fauveau, *et al.* (1991b).

1.4. Coding and classification

A single 3-digit code was to be selected from a list of 97 possible codes, derived from the "basic tabulation list" of the World Health Organisation (WHO) International Statistical Classification of Diseases, Injuries and Causes of Death (WHO, 1977).

Many of the codes proposed by the WHO basic tabulation list were not retained because they would be irrelevant in the context of lay reporting. On the other hand, new codes were introduced to account for frequent combinations of primary and underlying causes.

CONTINUED...
Assessment of Cause of Death

For example, three distinct 3-digit codes were used for measles: i) death from immediate complication of measles (during the rash period), ii) death from delayed respiratory complication of measles (within 6 weeks of the rash), and iii) death from delayed intestinal complication of measles. These three categories could then be used in aggregate form for a study of measles, or separately for studies of respiratory or diarrhoeal diseases.

As for diarrhoeal diseases, there were distinct codes for laboratory-confirmed cholera as opposed to other acute watery diarrhoeas, and distinct codes for laboratory-confirmed shigellosis as opposed to other cases of acute dysentery.

Malnutrition, a commonly associated or underlying cause of death, was coded differently when it was felt to be an associated cause or the single cause of death.

Copies of lists of codes (at the end of this chapter) are provided in annexes 4 (prior to 1986) and 5 (after 1986). Certain codes on the new list are marked with an asterisk, indicating that they can only be assigned if the diagnosis was confirmed by a paramedical test, such as an X-Ray, a laboratory test or by a specialist's report.

During the first year of the modified procedure, coding of cause of death of children aged less than five years was done by the principal investigator.

From the second year onwards, coding was done by the medical assistant in charge of reading death forms.

1.5. Supervision

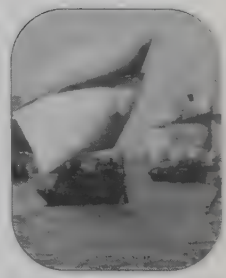
Supervisory checks were set up at every stage of the procedure to assign cause of death. Health assistants supervised the CHWs' detection of deaths in the field through independent household visits, and were in turn supervised by senior health assistants and field research officers for appropriate filling and returning of death forms.

Regular meetings of health assistants and their supervisors were held in the central office to review progress, discuss problems, search for missing cases, handle forms returned to the field for additional information, and deal with leave coverage.

The work of the medical assistant in charge of reading death forms was supervised by two physicians and by the principal investigator. At regular intervals, death forms were randomly drawn and checked, and difficult cases were reviewed.

1.6. Special procedures for neonatal deaths

Recognizing the particular difficulties in assessing the cause of



neonatal deaths, especially in areas where neo-natal tetanus is known to be frequent, an additional procedure was set up from the beginning of 1986 to ensure optimum quality in the assessment of this cause.

The issue of misdiagnosing (mostly overdiagnosing) tetanus as a cause of neonatal death has been raised previously in several publications (Chen, *et al.*, 1980; Zimicki, *et al.*, 1985; Zimicki, 1986). It was found that all neonatal deaths perceived to be caused by evil spirits (such as those unexplained by the current medical knowledge), including those with convulsions, stiffness or coma, were classified in the same category as neonatal tetanus.

To sort this problem out, a special questionnaire was designed, translated into Bengali, and administered in all cases of neonatal deaths which had occurred between the 4th and 21st day of life (see English version in Annex 6, at the end of this chapter). This restriction was based on the biological implausibility of dying from neonatal tetanus before or after these ages.

The questionnaire, of which an English translation is shown in Annex 8 (at the end of this chapter), was administered in Bengali by a specially trained female interviewer, well-aware of local beliefs and local terminology. It focused on identification of the main criteria for neonatal tetanus: no particular complication at birth, good suckling and crying patterns during the first 48 hours, lockjaw and difficulty in suckling as the first symptoms, spasms of neck and body, rigidity (opisthotonos), signs of infection of the umbilical stump.

The questionnaire was also designed to identify and differentiate prematurity and intra-uterine growth retardation as underlying causes of neonatal death. Relevant questions were asked about size at birth (rated by mother or attendants as average, above, or below average), duration of pregnancy, and problems during pregnancy. There were also questions on the conditions of delivery, care given to the umbilical stump, maternal coverage with tetanus toxoid immunisation.

Since the introduction of this special questionnaire in 1986, all cases have been reviewed and coded by the principal investigator, ensuring consistency of judgement.

1. 7. Special procedure for adult female deaths

It was also felt that the standard procedure might lead to misdiagnosing cause of death among adult women. As for neonatal deaths, a woman-to-women interview was felt potentially superior to a man-to-women interview to collect accurate and precise information.

The most difficult and important cause to detect was complication of abortion, particularly induced abortion. Previous reports of abortion deaths in rural Bangladesh suggested many difficulties in assessing this cause of death, particularly among young unmarried women (Rochat, *et al.*, 1981; Khan, *et al.*, 1986).

Again a special questionnaire was designed, to be administered by a trained female interviewer in all cases of death of women aged 15 to 45 years (see English version in Annex 7). This questionnaire focused on menstrual status at the time of death (either menstruating regularly, amenorrhoeic or pregnant), family planning practice, dates of birth and death of previous child, desire for additional children, presence of social, familial or marital problems prior to death, and exact circumstances of death.

The female interviewer, known and respected in the area for her integrity, sometimes talked to other women in the compound and neighbouring compounds. The information collected was again read, discussed and assessed by a the principal investigator, thus ensuring consistency.

CONTINUED...

Assessment of Cause of Death

1.8. Analysis and presentation of results

The 3-digit codes are entered in annual death files produced by the DSS, containing exact dates of birth (when known) and death, thus allowing computerized calculation of exact age at death, and

classification into age groups: neonates less than 1 month, post-neonates 1 to 11 months, children 12 to 59 months, women of reproductive age from 15 to 44 years. These death files also contain coded information on place of death, doctor(s) consulted prior to death, marital status at death, as well as identification numbers to allow linkages with census and other files. Causes of death can then be grouped easily into categories, using primary or underlying causes.

Results are presented in tables organized by age/sex groups and broad categories of causes. There is often an advantage in grouping years to smooth the effect of annual variations (except for analysis of time-trends).

Tables contain a column for exact numbers (N), a column for proportional mortality rates (PMR) or percentage distribution, and a column for cause-specific mortality rates (CSMR) per 1,000 or 100,000 person/years exposed.

Mid-year populations were provided by the annual DSS census updates. Statistical significance of differences between CSMRs (for example between two areas, or two periods, or between males and females) was assessed by using standard tests for incidence density or rate ratio (Kleinbaum, *et al.*, 1982).

2. RESULTS

Tables 1 to 4 on the following pages present cause of death information for 1986-87 in the Matlab MCH-FP and Comparison areas for neonates, post-neonates, children, and women of reproductive age, respectively.

Earlier publications reported detailed findings and discussion on causes of:

neonatal deaths (Fauveau, *et al.*, 1990a),

post-neonatal deaths and deaths of children aged 6 to 36 months (Fauveau, *et al.*, 1990b),

adult female deaths (Fauveau, *et al.*, 1989a),

maternal deaths (Fauveau, *et al.*, 1988),

deaths due to malnutrition (Fauveau, *et al.*, 1990c),

deaths due to diarrhoea (Fauveau, *et al.*, 1989d), and

deaths due to acute respiratory infection (Fauveau, *et al.*, 1990e),

deaths due to injuries and induced abortion among women (Fauveau, *et al.*, 1989b)

Another example of potential uses of cause of death information is provided in Table 5, showing cause-specific and proportional mortality among children aged 1 to 4 years by sex.

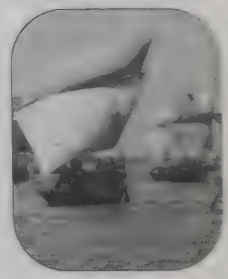
Diarrhoeal diseases and severe malnutrition emerge as the specific causes of child death that explain the higher female than male child mortality previously reported in rural Bangladesh by D'Souza & Chen (1980), Koenig & D'Souza (1986), and Fauveau, *et al.* (1991c).

3. DISCUSSION

The modified procedure to assess cause of death in Matlab since 1986 was introduced with the following objectives: to improve consistency in coding and to facilitate supervision — offering a greater choice of codes, minimizing forced compliance and allowing greater flexibility in classification.

To examine whether these objectives have been met, validation studies should be undertaken. With few exceptions, validation studies all confront the problem of the absence of a "gold standard". Attempts to validate verbal autopsies have been made elsewhere, with inconsistent conclusions (Gray, *et al.*, 1990; Kalter, *et al.*, 1990; Alonso, *et al.*, 1984). Related issues are now discussed.

CONTINUED...
Assessment of Cause of Death



Validation issues

Several attempts to validate the modified procedure in Matlab are reported below. Some are restricted to a mere discussion of feasibility or relevance, while others are true attempts to compare findings of the modified procedure with those of the previously used procedure.

Here again, the challenge lies in the fact that cause of death assessed by verbal autopsy cannot be checked against real autopsy or necropsy, because the latter is almost never performed (except in the very rare cases of legal prescription, or on specific hospital-based studies (Butler, *et al.*, 1987).

Continued on P.76

TABLE 1

Cause of death among neonates (<30 days), Matlab, MCH-FP and Comparison areas, 1986-87. (Rates per 1,000 live-births)

	MCH-FP area			Comparison area			Difference between rates
CAUSE OF DEATH	N	Rate	%	N	Rate	%	
Complications of a small size at birth	132	19.8	44.1	144	18.8	34.8	1.1
Birth trauma	43	6.5	14.4	44	5.7	10.6	0.7
Neonatal tetanus	20	3.0	6.7	85	11.1	20.5	-8.1***
Acute respiratory infection	30	4.5	10.0	42	5.5	10.1	-1.0
Acute watery diarrhoea	1	0.2	0.3	3	0.4	0.7	-0.2
Acute dysentery	0	0.0	0.0	3	0.4	0.7	-0.4
Chronic diarrhoea	1	0.2	0.3	0	0.0	0.0	0.2
Other neonatal infections	32	4.8	10.7	36	4.7	8.7	0.1
Other neonatal complications	7	1.1	2.3	9	1.2	2.2	-0.1
Impossible to specify	33	5.0	11.0	48	6.3	11.6	-1.3
ALL CAUSES	**299**	**44.9**	**100.0**	**414**	**53.9**	**100.0**	**-9.1 ***

* $p<0.05$
*** $p<0.001$

Some totals do not add up because of rounding

CONTINUED...
Assessment of Cause of Death

TABLE 2

Cause of death among post-neonates in Matlab, Matlab MCH-FP and Comparison areas, 1986-87. (Rates per 1,000 live-births)

CAUSE OF DEATH	MCH-FP area (n=6,663)			Comparison area (n=7,677)			Difference between rates
	N	Rate	%	N	Rate	%	
Acute watery diarrhoea	25	3.8	10.2	35	4.6	11.7	-0.8
Acute dysentery	14	2.1	5.7	18	2.3	6.0	-0.2
Post-measles dysentery	1	0.2	0.4	3	0.4	1.0	-0.2
Chronic diarrhoea	16	2.4	6.6	8	1.0	2.7	1.4
Chronic diarrhoea with severe malnutrition	15	2.3	6.1	19	2.5	6.3	-0.2
TOTAL DIARRHOEAL DISEASES	**71**	**10.7**	**29.1**	**83**	**10.8**	**27.7**	**-0.2**
Acute lower respiratory infection	66	9.9	27.0	97	12.6	32.3	-2.7
Acute lower respiratory infection with severe malnutrition	10	1.5	4.1	10	1.3	3.3	0.2
Post-measles pneumonia	1	0.2	0.4	2	0.3	0.7	-0.1
Whooping cough	2	0.3	0.8	5	0.7	1.7	-0.4
TOTAL ACUTE RESPIRATORY INFECTION	**79**	**11.9**	**32.4**	**114**	**14.8**	**38.0**	**-3.0**
Measles	1	0.2	0.4	2	0.3	0.7	-0.1
Tetanus	0	0.0	0.0	10	1.3	3.3	-1.3
Skin and subcutaneous infection	3	0.5	1.2	3	0.4	1.0	0.1
Fever of unknown origin	7	1.1	2.9	8	1.0	2.7	0.0
Other infectious diseases	3	0.5	1.2	3	0.4	1.0	0.1
TOTAL OTHER INFECTIOUS DISEASE	**14**	**2.1**	**5.7**	**26**	**3.4**	**8.7**	**-1.3**
OTHER SEVERE MALNUTRITION	**31**	**4.7**	**12.7**	**26**	**3.4**	**8.7**	**1.3**
Drowning	6	0.9	2.5	2	0.3	0.7	0.6
Extended burns	0	0.0	0.0	1	0.1	0.3	-0.1
Other accidents	13	2.0	5.3	7	0.9	2.3	1.0
TOTAL INJURIES/ACCIDENTS	**19**	**2.9**	**7.8**	**10**	**1.3**	**3.3**	**1.5**
Other causes	11	1.7	4.5	13	1.7	4.3	0.0
Impossible to specify	19	2.9	7.8	28	3.6	9.3	-0.8
TOTAL UNSPECIFIED	**30**	**4.5**	**12.3**	**41**	**5.3**	**13.7**	**-0.8**
ALL CAUSES	**244**	**36.6**	**100.0**	**300**	**39.1**	**100.0**	**-2.5**

TABLE 3

Cause of death among children 1 to 4 years, Matlab, MCH-FP and Comparison areas, 1986-87. (Rates per 1,000 children aged 1 to 4 years)

CAUSE OF DEATH	MCH-FP area (n=22,331)			Comparison area (n=24,560)			Difference between rates
	N	Rate	%	N	Rate	%	
Acute watery diarrhoea	16	0.7	6.5	18	0.7	4.2	0.0
Acute dysentery	28	1.3	11.3	30	1.2	7.0	0.0
Post-measles dysentery	2	0.1	0.8	39	1.6	9.1	-1.5***
Chronic diarrhoea	18	0.8	7.3	24	1.0	5.6	-0.2
Chronic diarrhoea with severe malnutrition	59	2.6	23.9	128	5.2	29.8	-2.6***
TOTAL DIARRHOEAL DISEASES	**123**	**5.5**	**49.8**	**239**	**9.7**	**55.6**	**-4.2*** **
Acute lower respiratory infection	24	1.1	9.7	37	1.5	8.6	-0.4
Acute lower respiratory infection with severe malnutrition	3	0.1	1.2	8	0.3	1.9	-0.2
Post-measles pneumonia	0	0.0	0.0	14	0.6	3.3	-0.6
Whooping cough	2	0.1	0.8	4	0.2	0.9	-0.1
TOTAL ACUTE RESPIRATORY INFECTION	**29**	**1.3**	**11.7**	**63**	**2.6**	**14.7**	**-1.3****
Measles	1	0.0	0.4	1	0.0	0.2	0.0
Tetanus	2	0.1	0.8	2	0.1	0.5	0.0
Rabies	0	0.0	0.0	1	0.0	0.2	0.0
Skin and subcutaneous infection	2	0.1	0.8	3	0.1	0.7	0.0
Fever of unknown origin	6	0.3	2.4	8	0.3	1.9	-0.1
Other infectious diseases	3	0.1	1.2	5	0.2	1.2	-0.1
TOTAL OTHER INFECTIOUS DISEASE	**14**	**0.6**	**5.7**	**20**	**0.8**	**4.7**	**-0.2**
OTHER SEVERE MALNUTRITION	**13**	**0.6**	**5.3**	**26**	**1.1**	**6.0**	**-0.5**
Drowning	51	2.3	20.6	50	2.0	11.6	0.3
Extended burns	2	0.1	0.8	2	0.1	0.5	0.0
Other accidents	2	0.1	0.8	2	0.1	0.5	0.0
TOTAL INJURIES/ACCIDENTS	**55**	**2.5**	**22.3**	**54**	**2.2**	**12.6**	**0.3**
Other causes	2	0.1	0.8	10	0.4	2.3	-0.3
Impossible to specify	11	0.5	4.5	18	0.7	4.2	-0.2
TOTAL UNSPECIFIED	**13**	**0.6**	**5.3**	**28**	**1.1**	**6.5**	**-0.6**
ALL CAUSES	**247**	**11.1**	**100.0**	**430**	**17.5**	**100.0**	**-6.4*** **

** p<0.01
*** p<0.001

Some totals do not add up because of rounding

TABLE 4

Cause of death among women 15 to 44 years in Matlab, MCH-FP and Comparison areas, 1986-87. (Rates per 10,000 women 15-44 years)

CAUSE OF DEATH	MCH-FP area (n=44,317)			Comparison area (n=40,675)			Difference between rates
	N	Rate	%	N	Rate	%	
Acute watery diarrhoea	3	0.7	2.9	4	1.0	3.5	-0.3
Acute non-watery diarrhoea	3	0.7	2.9	2	0.5	1.7	0.2
Persistent diarrhoea	6	1.4	5.9	4	1.0	3.5	0.4
Acute respiratory infection	1	0.2	1.0	1	0.2	0.9	0.0
Chronic respiratory infection	6	1.4	5.9	7	1.7	6.1	-0.4
Other infectious diseases	16	3.6	15.7	18	4.4	15.7	-0.8
TOTAL INFECTIOUS DISEASES (excluding obstetric. sepsis)	**35**	**7.9**	**34.3**	**36**	**8.9**	**31.3**	**-1.0**
Abortion	6	1.4	5.9	15	3.7	13.0	-2.3*
Postpartum sepsis	1	0.2	1.0	2	0.5	1.7	-0.3
Postpartum haemorrhage	7	1.6	6.9	4	1.0	3.5	0.6
Eclampsia	4	0.9	3.9	5	1.2	4.3	-0.3
Obstructed labour	1	0.2	1.0	2	0.5	1.7	-0.3
Other obstetric	3	0.7	2.9	7	1.7	6.1	-1.0
TOTAL DIRECT OBSTETRIC	**22**	**5.0**	**21.6**	**35**	**8.6**	**30.4**	**-3.6***
Unintentional injury (accident)	7	1.6	6.9	5	1.2	4.3	0.3
Intentional injury (suicide)	10	2.3	9.8	7	1.7	6.1	0.5
Intentional injury (homicide)	1	0.2	1.0	1	0.2	0.9	0.0
TOTAL INJURIES	**18**	**4.1**	**17.6**	**13**	**3.2**	**11.3**	**0.9**
NON-INFECTIOUS DISEASES (acute and chronic)	**9**	**2.0**	**8.8**	**14**	**3.4**	**12.2**	**-1.4**
OTHER CAUSES	**13**	**2.9**	**12.7**	**12**	**3.0**	**10.4**	**0.0**
IMPOSSIBLE TO SPECIFY	**5**	**1.1**	**4.9**	**5**	**1.2**	**4.3**	**-0.1**
ALL CAUSES	**102**	**23.0**	**100.0**	**115**	**28.3**	**100.0**	**-5.3**

* : $p<0.05$

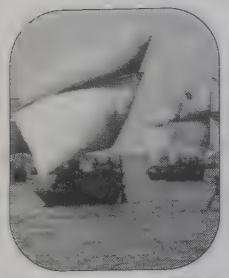
Some totals do not add up due to rounding off.

TABLE 5

Cause of death by sex among children, Matlab 1986-87. (Rates by 1,000 children aged 1-4 years)

CAUSE OF DEATH	Male (n=24,219)			Female (n=22,652)			Difference between rates
	N	Rate	%	N	Rate	%	
Acute watery diarrhoea	12	0.5	4.7	22	1.0	5.2	0.5
Acute non-watery diarrhoea	21	0.9	8.3	35	1.5	8.3	0.7*
Post-measles diarrhoea	14	0.6	5.5	27	1.2	6.4	0.6*
Persistent diarrhoea	12	0.5	4.7	31	1.4	7.3	0.9**
TOTAL DIARRHOEAL DISEASES	**59**	**2.4**	**23.2**	**115**	**5.1**	**27.2**	**2.6*** **
SM with chronic diarrhoea	52	2.1	20.5	136	6.0	32.2	3.9***
SM with respiratory infection	3	0.1	1.2	8	0.4	1.9	0.2
Other severe malnutrition	16	0.7	6.3	23	1.0	5.4	0.4
TOTAL SEVERE MALNUTRITION	**71**	**2.9**	**28.0**	**167**	**7.4**	**39.5**	**4.4*** **
Acute lower respiratory infection	34	1.4	13.4	27	1.2	6.4	-0.2
Immunizable (+)	12	0.5	4.7	13	0.6	3.1	.0.1
Fever, septicaemia	5	0.2	2.0	10	0.4	2.4	0.2
Other infectious diseases	4	0.2	1.6	10	0.4	2.4	0.3
TOTAL OTHER INFECTIOUS DISEASES	**55**	**2.3**	**21.7**	**60**	**2.6**	**14.2**	**0.4**
Drowning	50	2.1	19.7	51	2.3	12.1	0.2
Other accidents	4	0.2	1.6	4	0.2	0.9	0.0
TOTAL INJURIES/ACCIDENTS	**54**	**2.2**	**21.3**	**55**	**2.4**	**13.0**	**0.2**
OTHER CAUSES	**3**	**0.1**	**1.2**	**9**	**0.4**	**2.1**	**0.3**
IMPOSSIBLE TO SPECIFY	**12**	**0.5**	**4.7**	**17**	**0.8**	**4.0**	**0.3**
ALL CAUSES	**254**	**10.5**	**100.0**	**423**	**18.7**	**100.0**	**8.2*** **

(+): measles, pertussis, tetanus
* : $p<0.05$
** : $p<0.01$
***: $p<0.001$



Attempts have been made to check verbal autopsies against hospital diagnoses, by reading hospital therapy sheets of patients who died during admission or promptly after discharge. The method did not prove useful because most hospital therapy sheets carried only an admission diagnosis and no discharge diagnosis.

The common practice in the region is for the relatives to take back their patient when they judge his/her condition hopeless.

Of the very few patients who died while in the hospital, however, all verbal autopsies matched hospital diagnoses. The issue of inter-observer variation to collect information concerning circumstances of death was not addressed with interviewers of the same gender, because it would have upset families.

In the special cases of neonatal deaths and adult female deaths, however, it was observed that female interviewers using a structured questionnaire were always able to collect more information than their male counterparts.

It was also observed that male health assistants tended to interview male relatives, while female interviewers tended to talk to female relatives, who are more aware of details concerning neonates and women.

CONTINUED...

Assessment of Cause of Death

To illustrate this point, and estimate the extent of over-reporting of neonatal tetanus as a cause of neonatal death during the pre-1986 period, 563 neonatal death reports carrying diagnoses made by male health assistants were compared with cause of death assessed by physicians using information provided by female interviewers according to the modified procedure.

Results in Table 6, facing page, show that in 17 per cent (97/563) of all cases examined, both the old and new systems agreed that the cause of death was neonatal tetanus. In 39 per cent (222/563) of all cases they agreed that the cause of death was not neonatal tetanus, resulting in an overall degree of agreement of 56 per cent.

If it is accepted that the new method is closer to the "gold standard" than the old one, sensitivity of the old method to detect neonatal tetanus death can be estimated at 66 per cent, with a specificity of 53 per cent, and a positive predictive value of 34 per cent. Interpretations of previous reports about neonatal tetanus in rural Bangladesh must be considered with this limitation in mind.

Another way of examining inter-observer variation was to compare diagnoses made by the three physicians involved in reading the 1,008 death forms of children aged less than five years during the year 1986. As shown in Table 7, facing page, they agreed fully in 49 per cent of all cases, partially in 21 per cent, and they disagreed in the remaining 30 per cent.

Rates of full agreement increased with the age of children whose death report was examined, in contrast to rates of partial and complete disagreement, indicating that the assessment of cause of death was more often subject to problems among neonates than among older children.

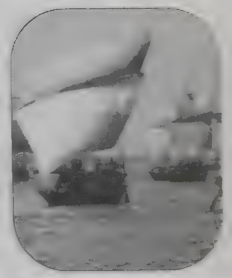
The causes of death with the highest rates of disagreement were acute respiratory infection in all age groups, complications of prematurity and dysmaturity in neonates, and conditions associated with severe malnutrition. Disagreement also arose in cases when fever or fits were the only reported symptoms.

The modified procedure introduced questions about recent noticeable wasting of children prior to death, in an effort to determine the role of severe malnutrition. Given the large number of children surveyed in the study area, it was not possible to have an objective measure of the degree of malnutrition of those who died.

In half of the study area, however, where the maternal and child health project was implemented, field workers regularly measure mid-upper-arm circumference (MUAC) of all children aged 6 to 60 months (Briend, *et al.*, 1987).

In a subsample of 253 deaths of children in this age group for which the MUAC had been measured within one month of death, the degree of agreement between severe malnutrition assessed by verbal autopsy and by MUAC was 86 per cent (sensitivity 76 per cent, specificity 91 per cent for a MUAC less than 110 mm, Fauveau, *et al.*, 1990).

Similarly, the modified procedure introduced questions about the size of neonates at birth (bigger or smaller than "average"). This was part of an effort to determine the role of complications of a small size at birth in settings (such as Matlab) where birth weight is very difficult to measure in the community. As part of the maternity care programme introduced in one part of the area in 1987, midwives were trained to measure chest circumference at birth in the community (see Chapter 8).



In a subsample of 18 neonatal deaths for which chest circumference at birth had been measured, the degree of agreement between a small size at birth assessed by verbal autopsy and by a chest circumference was 94 per cent (sensitivity 82 per cent, specificity 100 per cent, positive predictive value 100 per cent).

■

TABLE 6

Neonatal tetanus diagnosed by male health assistants and female interviewer, Matlab DSS, 1985-86.

		Diagnosis by physician on the report by female interviewer		
		NNT	not NNT	ALL
Diagnosis by male health assistant	NNT	97	195	282
	not NNT	49	222	271
	ALL	146	417	563

Sum of positive and negative agreement : 17% + 39% = 56%
Sensitivity of diagnosis by male health assistant : 66%
Specificity of diagnosis by male health assistant : 53%
Positive predictive value : 34%

TABLE 7

Agreement between 3 physicians interpreting the same verbal autopsy report, Matlab 1986, (n=1,008 deaths).

AGREEMENT	Neonates	Post-neonates	Children	ALL
% fully agree	39	45	60	49
% partially agree	26	22	17	21
% disagree	35	33	23	30
	100	100	100	100

CONTINUED...

Assessment of Cause of Death

CHAPTER 5

Assessment of Cause of Death in the Matlab Demographic Surveillance System

Vincent Fauveau, Bogdan Wojtyniak, Hafizur Rahman Chowdhury & Abdul Majid Sarder

Lessons learned...

The efforts to improve quality and reliability of the assessment of cause of death reported in this paper were prompted by the need to prioritize health interventions and to refine the evaluation of their impact on mortality. A number of health interventions have been implemented in Matlab since 1986, and their evaluation has been carried out using changes in age-and-cause-specific mortality. Because the level of confidence that can be put on the absolute values of cause-specific mortality rates may vary a lot, a reasonable and often more powerful alternative is to study trends of cause-specific mortality rates. The study of trends, however, may only apply to a limited number of causes of death, and only if these causes have been consistently assessed in the same manner over the period studied.

Caution must be exercised before recommending extension and replication of the method described in this paper, on several grounds.

First, more work is needed on validation, and, keeping in mind the quasi-impossibility of using a gold-standard , innovative approaches should be found.

Second, a careful revision of the classification of causes of death based on clinical symptoms, not on sophisticated hospital-based findings, should be undertaken for use in areas resorting to verbal autopsy.

Third, given that certain causes of death are far more difficult to assess than others, it may be wise to restrict the scope of this method to a limited number of possible causes that meet reasonable criteria of feasibility.

Fourth, the costs of maintaining quality and supervision in a demographic surveillance system should not be underestimated.

Finally, a symptom-based assessment of causes of death, such as the one described in this paper, is highly culture-specific and requires considerable preliminary work on local perceptions of health and disease.

Annex 1 : Facsimile of Death Registration Form used in the Matlab DSS prior to the 1986 changes (sample).

DEATH REGISTRATION FORM

ICDDR,B/MATLAB

Serial No. 16 (1–3) Village Code : V56 (4–6) Date of death : 30 11 83 (DD MM YY, 7–12)

Name of deceased : Zazzatunnessa Date of birth : 0 0 53 (DD MM YY, 13–18) Sex : [1] M [X] F [3] UNK (19)

Current id No. V56 - 217 - 2 (20–29) Registration No. 1 V56 - 174 - 2 (30–39)

Mother's current id No. — (40–49) Registration No. — (50–59)

Marital Status at the time of death :

Never Married [1] Married [X] Widowed [3] Separated [4] Divorced [5] [ ] (60)

Education at death : M 12 (61–62) Occupation at death : H/W 17 (63–64)

Events and symptoms leading up to death :

Measles	02	Diarrhoea : Acute	07	Chronic	08
Tetanus	03	Dysentery : Acute	09	Chronic	10
Drowning	04	Childbirth	11		
Murder	05	Jaundice	12		
Suicide	06	Other not covered above	X	Fever	

Symptoms leading up to death : (65–66)

Had been suffering from fever for 2 months as a result she could not take meals regularly

Place of death : Village Pailpara P. S. Matlab Dist. Comilla Code V56 (67)

Type of Doctor Consulted :

Licenced Allopath [1] Allopath quack [2] Homeopath [3] Kabiraj [4] Other [5] Doctor not consulted [X] (68)

Reported by : Asthma Entered by : 6/1/12

Date : 19/12/83 Date : —

Date Entered : 19/12/83 Field Vol. Matlab Vol. 21/12/83

Remarks : P.T.O.

29/12/83

Annex 2 : Facsimile of Death Registration Form used in the Matlab DSS after the 1986 changes (blank model).

DR89

DEATH REGISTRATION FORM
DSS, ICDDR,B

Village _____

Village/Unit |_|_|_|

Serial No. |_|_|_|

HA _____ |_|_|

SHA _____ |_|_|

Place of death DSS: |_|_|_|
Village _____
Town _____
Upazila _____
District _____
Country _____
non-DSS: |_|_|*

Date of death |_|_|_|_|_|_|
day month year

Date of report |_|_|_|_|_|_|
day month year

PC Record No. |_|_|_|_|*

Current Id
MATLAB: village household ind xx
TEKNAF: vil para household ind

Registration Number
p village household ind xx
p vil para household ind

Name _____

Date of birth |_|_|_|_|_|_|
day month year

IF LESS THAN 1 DAY OLD: How many hours did is child live? |_|_|

Sex:
male 1 |_|
female 2 |_|
unknown 3 |_|

Which were consulted? (one or more):

Allopath registered |_| Allopath quack |_| Trained midwife |_|
Hospital inpatient |_| Homeopath |_| Spiritual |_|
Hospital outpatient |_| Kabiraj |_| None |_|
Dai, TBA |_| Other (specify) _____ |_|_|*

Description of events and symptoms leading to death:

Cause of death: _____ |_|_|_|*

Coded by _____ |_|_|*

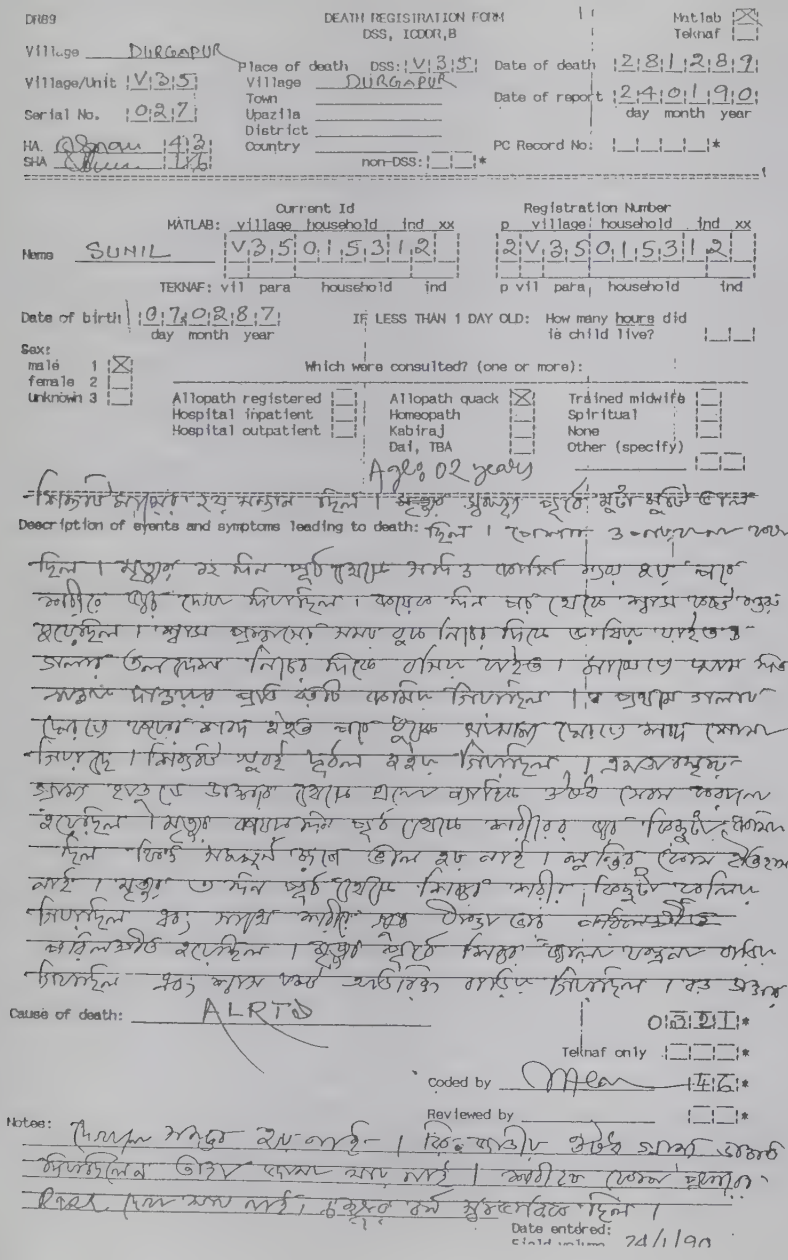
Reviewed by _____ |_|_|*

Notes:

Remarks _____

Date entered:
Field volume _____
Office volume _____

Annex 3 : Facsimile of Death Registration Form used in the Matlab DSS after the 1986 changes (sample).



DR89 DEATH REGISTRATION FORM DSS, ICDDR,B Matlab ☒ Teknaf ☐

Village: DURGAPUR Place of death DSS: V35 Date of death: 28/12/87

Village/Unit: V35 Village: DURGAPUR Date of report: 24/01/90

Serial No.: 027 Town / Upazila / District / Country / non-DSS: PC Record No:

HH: 413 SHA: 176

Current Id — MATLAB: village household ind xx: V35 01 53 12

Registration Number — p village household ind xx: 2V35 01 53 12

Name: SUNIL

TEKNAF: vil para household ind / p vil para household ind

Date of birth: 07/02/87 (day month year) IF LESS THAN 1 DAY OLD: How many hours did the child live?

Sex: male 1 ☒ female 2 ☐ unknown 3 ☐

Which were consulted? (one or more):

Allopath registered ☐ Hospital inpatient ☐ Hospital outpatient ☐ Allopath quack ☒ Homeopath ☐ Kabiraj ☐ Dai, TBA ☐ Trained midwife ☐ Spiritual ☐ None ☐ Other (specify) ☐

Age 02 years

Description of events and symptoms leading to death:

Cause of death: ALRTD

Teknaf only ☐

Coded by: Mean

Reviewed by ☐

Notes:

Date entered: Field volume 24/1/90

Annex 4 : Facsimile of Classification and code list of causes of death used prior to 1986, Matlab DSS.

International Centre for Diarrhoeal Disease Research, Bangladesh
Demographic Surveillance System (DSS), Codes for cause of Death
(prior to 1986)

CATEGORY	CODE
smallpox	01
measles	02
tetanus *(takuria,* evil spirit)	03
drowning	04
murder	05
suicide	06
diarrhoea (acute)	09
dysentery (chronic)	10
childbirth	11
jaundice	12
disease of G.I. (other than cholera) stomach pain	14
respiratory disease (cold fever, cough, TB, asthma)	15
heart disease	16
liver disease	17
venereal disease	18
skin disease	19
E.N.T. disease	20
cholera (proved)	21
dropsy	22
rheumatism	23
accident	24
old age complication	25
fever (all forms)	26
diabetes	27
cancer	27
cancer	29
appendicitis	30
other	91
unknown	99

Annex 5 : Facsimile of Classification and code list of causes of death used from 1986, Matlab DSS.

International Centre for Diarrhoeal Disease Research, Bangladesh
Matlab Demographic Surveillance System: Classification of cause of death, from Jan 1986 and correspondance between new codes and ICD codes

Notes :
- Not all codes have one correspondance
- * : causes for which hospital, laboratory, X-Ray, or specialist's confirmation is required.
- R : rare cause, does not need to be included in tabulations.
- # : all possible decimals for the four-digits codes are acceptable

CAUSE OF DEATH	DB-CODE FROM 1986	WHO-ICD
DIARRHOEAL DISEASES		
cholera (proven) (*)	001	001#
acute watery diarrhoea (any other)	010	001-3#, 008-9#
shigellosis (proven) (*)	012	004#
acute dysentery, with blood in stools	013	004#, 006#, 008#-9#
acute non-watery diarrhoea, with mucus and NO blood in stools	014	004-9#
persistent or recurrent dysentery (>14 days) with blood, and NO obvious malnutrition	016	002-4, 006, 008-9
persistent or recurrent diarrhoea (>14 days) w/NO blood and NO obvious malnutrition	017	004-9#
persistent or recurrent diarrhoea or dysentery (>14 days), with severe and/or recent malnutrition (wasting)	191	002-9#,263.8
diarrhoea (any kind) with pneumonia		
INFECTIOUS DISEASES		
pulmonary tuberculosis (*)	020	010-12,018#
diptheria (*,R)	033	032#
whooping cough (pertussis)	034	033#
meningitis (*)	036	036#, 320-2#
tetanus (EXCEPT neo-natal and post-partum)	037	037
septicemia (*)	038	038#
acute polio (*,R)	040	045-9#
measles (death within rash period)	642	055.0,055.8,055.9
post measles pneumonia (within 6 weeks of rash)	742	055.1, 484.0
post measles dysentery (within 6 weeks of rash)	842	055.7
viral hepatitis acute (death during initial jaundice period)	046	070#
rabies (R)	047	071
malaria (R,*)	052	084#
infection of skin or sub-cutaneous tissues	420	680-6#
NEOPLASMS		
malignant neoplasm of digestive organs (*)	099	140-59#
malignant neoplasm of respiratory organs (*)	109	160-5#
malignant neoplasm of female breast (*)	113	174#
malignant neoplasm of uterus (*)	122	179-84#
malignant neoplasm of other sites (*)	139	170-5#, 185-99#
leukemia (*)	141	200-8#
NUTRITIONAL		
diabetes mellitus (*)	181	250#
marasmus-kwashiorkor (nutritional oedema)	190	260-62#
severe and/or recent malnutrition associated with chronic/persistent diarrhoea	191	263.8
marasmus due to lack of breast feeding	192	783.3
marasmus due to insufficient food intake	193	783.3
marasmus due to other chronic infection (non-diarrhoeal, non-respiratory)	194	269.8
death associated with nutritional. blindness (R)	195	264#
MENTAL DISEASES		
psychoses	213	290-9#
physiological malnutrition arising from mental factor	217	306
CARDIO-VASCULAR DISEASES		
rheumatic heart disease, complication of (*,R)	251	390-1#
acute myocardial infarction (*)	270	410-4#
acute but ill-defined C.V. diseases (stroke)	293	342,430,448
late complication of the above	294	
RESPIRATORY DISEASES		
pneumonia, ALRI	321	464-6#, 480-7#
chronic respiratory disease, bronchitis, emphysema, asthma (complication of)	323	490-4
pneumonia with diarrhoea	325	
pneumonia, ALRI associated with, or as a complication of severe malnutrition	328	-
GASTRO-INTESTINAL DISEASES		
peptic ulcer (complication of)	341	531-5#
appendicitis, peritonitis (*,R)	342	540-3,567
intestinal obstruction	344	550-2, 560
chronic liver disease or cirrhosis (>1 month after initial jaundice)	347	571-2#
GENITO-URINARY DISEASES		
nephritis, nephrotic syndrome, renal failure (*,R)	350	580-6#
genito-urinary tract infection (unrelated to pregnancy), salpingitis (*,R)	371	614-5#
DIRECT OBSTETRIC COMPLICATIONS		
spontaneous abortion, miscarriage	380	634
induced abortion	382	635-8
haemorrhage of pregnancy	390	640-1
toxaemia, eclampsia	390	642#
infections in pregnancy (G.U. Tract)	392	646.6
obstructed labour, prolonged labour	393	652-3, 660-2#
other obstetric complications of pregnancy (ectopic preg, ruptured uterus, unknown)	394	643-8#

Continued overleaf...

post-partum haemorrhage (within 12 hours after birth)	395	666#	
post-partum haemorrhage (delayed, >12 hours after birth)	396	666#	
post-partum sepsis	397	670, 672	
post-partum tetanus	398	670	
other obstetric complications of post-partum	399	671, 673-4#	
NEONATAL PROBLEMS (WITHIN 30 DAYS)			
any congenital anomaly, obvious malformation	449	740-59#	
sudden infant death (suffocation during sleep)	450	798.0	
birth trauma	451	760-3#	
dysmaturity, small-for-date (including due to twin birth)	452	764#	
cord haemorrhage	453	767#	
hypoxia, birth asphyxia	454	768-70#	
neonatal tetanus	456	771.3	
other neonatal infections	457	771#	
prematurity (direct complication of)	458	765#	
unspecified neonatal death	459	772-9#	
MISCELLANEOUS			
fever of unknown origin	460	780.6	
oedema + ascitis of unspecified origin	461	782.3, 789.5	
anaphylaxis, allergic shock	468	995.0, 995.3	
IATROGENIC CAUSES			
complication of medical care by official health practitioners	540	996-9,	E870-9
complication of medical care by tradition health practitioners	541	"	"
complication of surgical care by official health practitioners	542	"	"
complication of surgical care by traditional health practitioners	543	"	"
ACCIDENTS, INJURIES			
transport accident	550	E800-38	
other accidental injuries	551	E850-69, E880-8, E916-28	
burns, complications of extended burns	552	948-9	E890-99
drowning	553	E910	
snake bite	554	E905.0	
homicide by violence	555	E965-9	
suicide by poisoning	557	E950	
other violent deaths, accidental suffocation accidental poisoning, lightning, electric shock	559	{799.0, 798.1 {994.7, 798.2	E911-28, E907 {994.8, 994.0
accidental falls due to epilepsy	560	-	E928
OTHER AND UNSPECIFIED			
other cause (specified but rare)	990	-	
senility (old age death without specified disease)	991	979	
impossible to specify	998	799	
unreported or unknown	999	-	

Annex 6 : Facsimile of Questionnaire for interview of mothers of attendants in cases of neonatal death between 4 and 21 days of age, Matlab DSS, 1986.

DSS MATLAB : NNT STUDY - QUESTIONNAIRE A

PART I : IDENTIFICATION MOTHER'S CID [| | | | | | |]

MOTHER'S NAME _____ RID [| | | | | | |]

DOB [/ /] DOD [/ /] SEX [ ] AGE AT DEATH [ ] (DAYS)

PART II: PREGNANCY, DELIVERY AND IMMEDIATE POST PARTUM PERIOD

DATE OF LMP (Bengali month): [ ] UNKNOWN

DURATION OF PREGNANCY IN MONTHS: [ ] UNKNOWN

WAS A SAFE DELIVERY KIT USED? : YES | NO | DON'T KNOW

PLACE OF DELIVERY? HOME | MATERNITY HOSP. | OTHER.....

WHAT WAS THE SIZE OF THE BABY AT BIRTH?
NORMAL | TOO SMALL | DON'T KNOW

ANY EVIDENT MALFORMATION SEEN AT BIRTH? YES | NO | UNKNOWN

HOW MANY HOURS AFTER BIRTH WAS THE BABY PUT ON BREAST?
[ ] UNKNOWN

WHAT WAS THE QUALITY OF SUCKING DURING THE SECOND AND THIRD DAYS? NORMAL | WEAK | NO SUCKING | UNKNOWN

PART III: SEQUENCE OF EVENTS AND SYMPTOMS PRECEEDING DEATH

USE VERSO OF THIS SHEET TO WRITE OPEN STATEMENT

HOW MANY DAYS AFTER BIRTH DID THE FIRST SYMPTOM START?
[ ] UNKNOWN

WAS THE BABY SUCKING AND BEHAVING NORMALLY BEFORE THE FIRST SYMPTOMS START? YES | NO | UNKNOWN

WHAT WAS THE FIRST SYMPTOM NOTICED? REFUSE TO SUCK, LOCK JAW, FEVER, CONVULSIONS, OTHER.....

WAS THERE A PARTICULAR MIMIC OF THE FACE? (DESCRIBE)
YES | NO | UNKNOWN

WAS THERE A SUCCESSION OF CALM PERIODS AND CONVULSIONS OR SPASMS?)
YES | NO | UNKNOWN

WAS THERE AN INCREASE IN CONVULSIONS (SPASMS) CAUSED BY STIMULATION?
YES | NO | UNKNOWN

WAS THERE A STIFFNESS OF THE NECK AND BACK LIKE ABOW?
YES | NO | UNKNOWN

" " " " " " ARMS AND HANDS INFLEXION? (FOLDED) YES | NO | UNKNOWN

" " " " " " LEGS AND FEET IN EXTENSION? (STRAIGHT) YES | NO | UNKNOWN

" " " CHANGE IN THE BODY COLOR DURING CONVULSIONS (SPASMS)? YES | NO | UNKNOWN

" " PRESENCE OF FEVER?

DESCRIBE ANY OTHER IMPORTANT EVENT OR SYMPTOM.....

PART IV:CONCLUSION NEONATAL TETANUS MOSTLIKELY | UNLIKELY | IMPOSSIBLE TO SPECIFY

MOTHER COVERED BY TT IMMUNIZATION [ ]

DSS CAUSE OF DEATH [ ]

Annex 7 : Facsimile of Questionnaire for interview of relatives and attendants in cases of an adult female death between 15 and 44 years of age, Matlab DSS, 1986.

DECEASED WOMAN CID : ..... RID ..... DOD: ...../...../AGE: .....Y CHW CODE NUMBER..... NAME.....

1. DID YOU KNOW THAT WOMEN ? | YES | NO |

2. WHAT WAS HER MENSTRUAL STATUS (2-3 MONTHS BEFORE HER DEATH) ? | P | N. | A. | PPA. | MENOPAUSE | UNKNOWN | PREMENSES |

3. WHAT WAS HER CONTRACEPTIVE STATUS (2-3 MONTHS BEFORE HER DEATH) ? | P. | L. | I. | S. | C. | OTHER | NONE | UNKNOWN | NA |

4. DO YOU REMEMBER THE CIRCUMSTANCES OF HER DEATH ? | YES | NO | IF YES DESCRIBE.....
(use back of this form)

5. WAS SHE KNOWN BY YOU AS PREGNANT BEFORE DEATH ? | YES | NO | NOT SURE | IF YES: 1. HOW LONG ? ..... MONTH 2. WAS IT HER FIRST PREGNANCY ? | YES | NO | UNKNOWN |

3. WAS THE PREGNANCY: | UNWANTED | ACCEPTED | ILLEGITIMATE | DESIRED |

4. STOP HERE

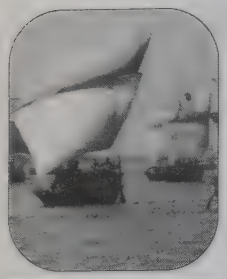
6. DO YOU REMEMBER OF ANY ABNORMAL SYMPTOMS OR COMPLAINS IN THE WEEK(S) PRIOR TO DEATH, RELATED TO PREGNANCY OR ANY OTHER CONDITION ? (LIKE ABNORMAL BLEEDING, HAEMORRHAGE, NAUSEA, VOMITING, DIZZINESS, FEVER, CHILLS, FAINTS, CONVULSIONS, PELVIC PAINS, ACCIDENT, BEATEN) | YES | NO | IF YES, DESCRIBE .....

7. DID YOU KNOW OF ANY SOCIAL/FAMILIAL/MARITAL PROBLEM OF THE WOMAN IN THE MONTH(S) BEFORE DEATH ? | YES | NO | IF YES, DESCRIBE THE PROBLEM .....

8. WAS THAT WOMAN KNOW AS HAVING A PERMANENT (LONG TIME) PHYSICAL PROBLEM ? (LIKE MALFORMATION OF BONES, EPILEPSY, CHRONIC DEPRESSION, CHRONIC PELVIC INFECTION, TB,. SURGICAL OPERATION OF ABDOMEN.....) | YES | NO | IF YES, DESCRIBE .....

9. OTHER RELEVANT INFORMATION

10. CONCLUSION: | PREGNANT | NOT PREGNANT | SUSPECTED / UNLIKELY |



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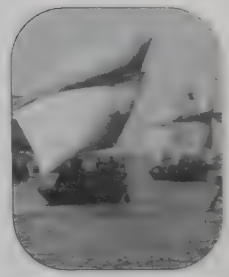

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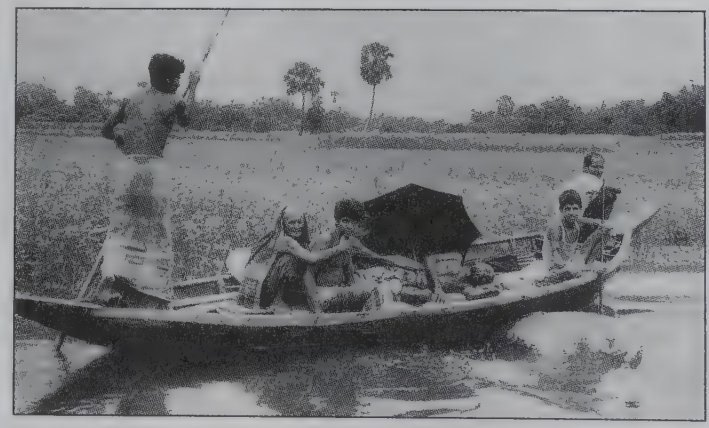
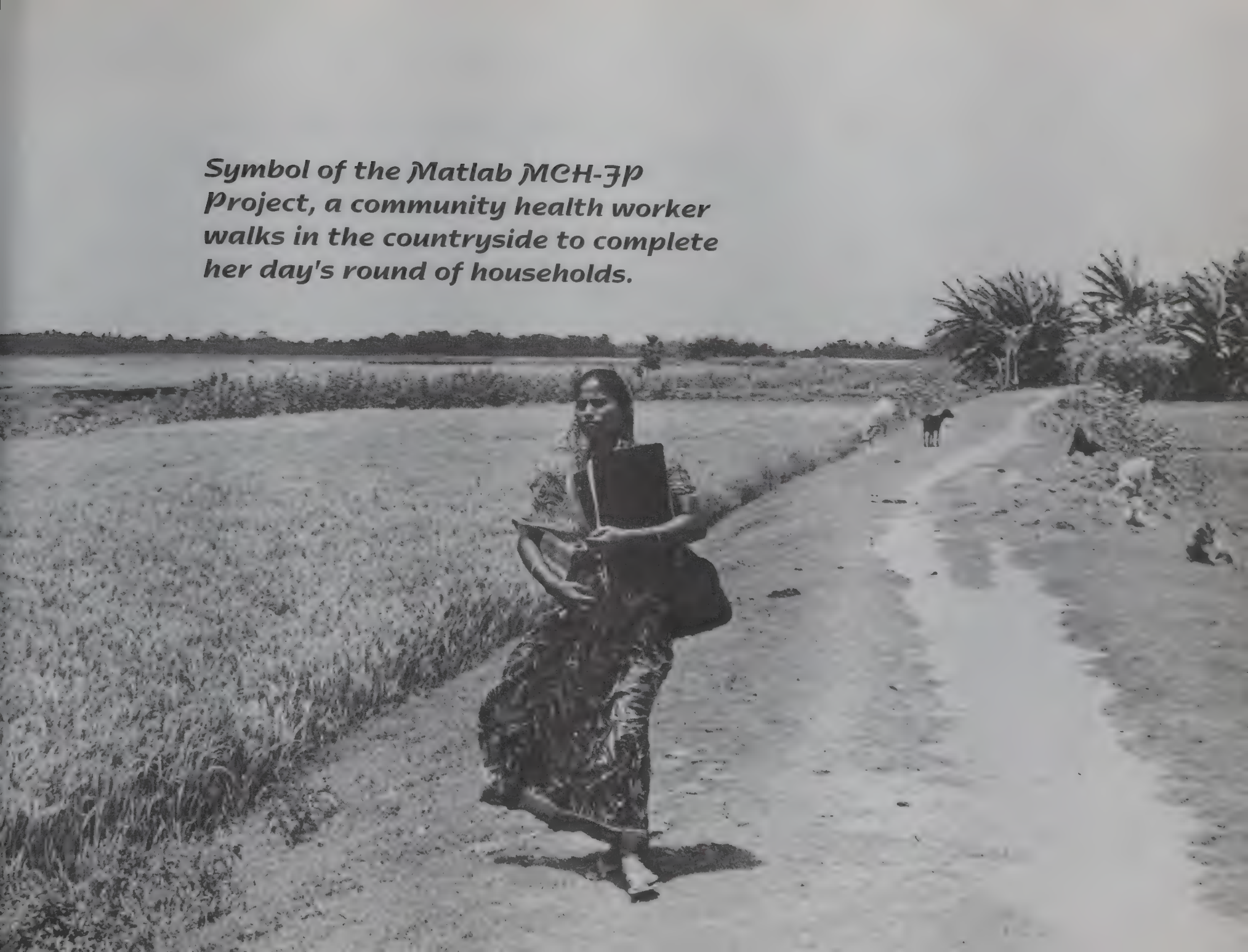


Rare among infants, cholera is still a common cause of death among the elderly in Matlab



Symbol of the Matlab MCH-FP Project, a community health worker walks in the countryside to complete her day's round of households.

CHAPTER 6

Family Planning and Maternal and Child Health Services in Matlab

Vincent Fauveau
Jyotsnamoy Chakraborty

Part II

This chapter is a review of the Matlab experience in family planning including the integration of family planning (FP) with mother and child health (MCH) services. Between 1975 and 1991, more than 120 papers have been published on family planning issues in Matlab, making it the single most studied family planning programme in the developing world. As mentioned earlier, the pressure of the fast-growing population in Bangladesh, recognized from the end of the Civil War in 1972, has led to population control being made the first priority for the new Government (Government of Bangladesh 1973). In 1990, it remains the first priority, and will continue to be so in the decades to come.

The design and components of the three major phases of the Matlab family planning and mother and child health programmes are first described. The methods of evaluation and results are then presented. Finally the main lessons learned are outlined.

1. DESIGN AND COMPONENTS OF THE MATLAB FAMILY PLANNING AND MOTHER AND CHILD HEALTH PROGRAMMES

1.1. First Phase: The Contraceptive Distribution Project

A national programme emphasizing female sterilization as the leading method of population control was in place in 1975 when it was proposed that reversible methods should also be introduced. A saturation trial was planned and implemented in Matlab.

This two-year trial, called the Contraceptive Distribution Project (CDP), was carried out from 1975 to 1977 in 150 villages of the Matlab study area. Another 84 villages were retained as a comparison group. The aim of the CDP was to explore the latent demand for contraception in rural Bangladesh (Osteria, *et al.*, 1978; Rahman, *et al.*, 1980). The project involved the distribution of oral pills and condoms by 153 Lady Village Workers. These women were illiterate, elderly, non-medically-trained village midwives (also called *dais*). These women were only involved in supplying contraceptives and there was no monitoring of side-effects or discontinuation.

Although in the first three months, the project was successful, raising levels of contraceptive use from a baseline one per cent to 18 per cent of eligible couples, it had a limited long-term impact: the contraceptive use rate returned to initial levels, and there was virtually no demographic impact (Stinson, *et al.*, 1982).

It was found that the main factors responsible for the return to the initial low usage pattern were due to a number of shortcomings related to a neglected supply strategy: insufficient planning, minimal training of suppliers, commodity distribution rather than service distribution, no adaptation to specific patterns of demand, no monitoring of side-effects, and lack of alternative methods to ensure continued contraceptive use.

However, two main lessons were learned: there was a strong demand in the community, and there was a need to explore supply systems.

1.2. Second Phase: The Family Planning-Health Services Project

1.2.1. Design

In 1977, drawing on the lessons learned in the previous project, a decision was made to address population and family planning issues on a larger scale and in a more scientific way.

A project called the Family Planning-Health Services Project (FPHSP, was established, emphasizing comprehensive and effective supply of contraceptives. The objective was to test the hypothesis that an appropriate system of family planning services delivery can induce and sustain contraceptive use and fertility decline in a setting, such as rural Bangladesh where socio-economic conditions were not conducive to a decrease in fertility.

The study area was divided into a treatment area - 70 villages with a population of 89,000, receiving the ICDDR,B family planning and health services — and a neighbouring comparison area — 79 villages with approximately the same population, receiving the regular government family planning and health services.

The treatment area was further split into 4 operational blocks (A,B,C,D), each of them organized around a small MCH-FP clinic staffed by paramedical personnel (Bhatia, *et al.*, 1980) (See map in Figure 1 of Chapter 4, page 52).

1.2.2. Components

The key component of the Matlab FPHSP was the recruitment and posting of local female community health workers (CHWs). Coming from respected families and allowed to visit any other house of their village, the CHWs were young, educated, and married. They were asked to go out and visit all households of their village bi-weekly, in a cycle covering about 20 home visits per day.

The CHWs carried a range of contraceptive methods (oral pills, condoms, injectables, spermicides), and were able to refer interested women to the nearest subcentre clinic or to Matlab for IUD insertion, tubectomy or menstrual regulation. Most important among their tasks, the CHWs were able to counsel women about contraception and motivate them for sustained use.

CHWs were backed up by a cadre of resident female paramedical workers with 18 months of formal training in family planning and MCH. Each of the four subcentre clinics had appropriate equipment and drugs to treat common illnesses and family planning-related problems. A male health assistant was posted in each subcentre to supervise the CHWs and to take charge of administrative matters.

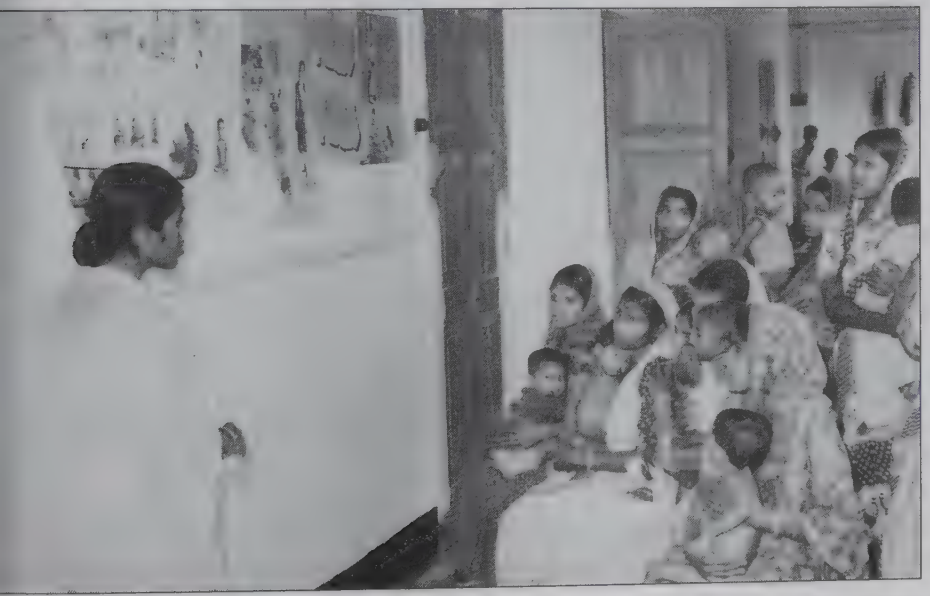
The 20 CHWs in each block had to meet twice monthly at the subcentre with their supervisors to discuss problems, exchange information, replenish their supplies and undergo additional training. On the days of the meetings, female doctors from the central clinic in Matlab would visit each subcentre to examine patients with special needs and ensure on-the-spot training.

This high level of supervision, together with the emphasis on in-service training, enabled CHWs to develop a trustful relationship

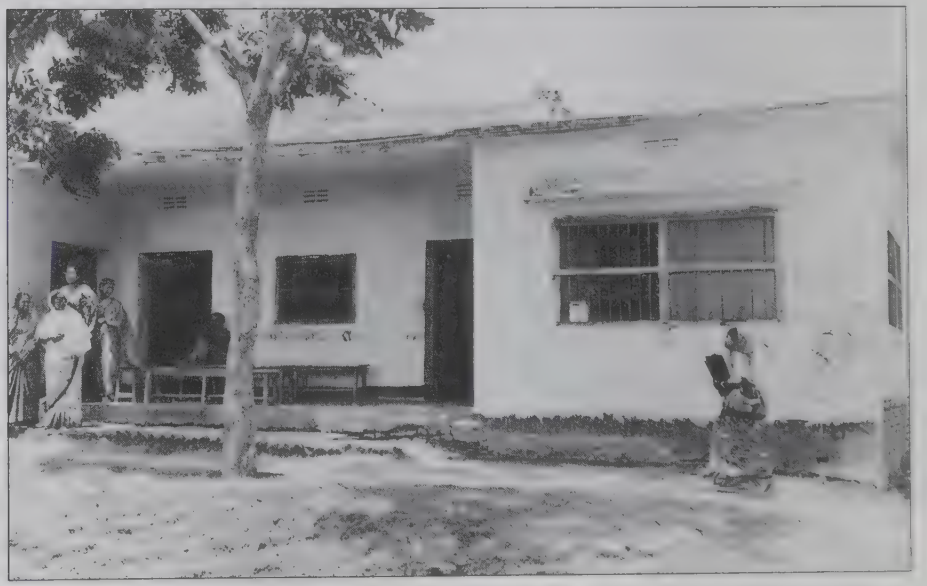
CONTINUED...
Family Planning and Maternal and Child Health Services

A community health worker demonstrates the injectable contraceptive DMPA to a group of women of her village. Injectables are the most popular contraceptives in the project area.

The Matlab MCH-FP "family". About seventy per cent of the staff hired at the origin of the Project fifteen years ago are still there.



Health education while you wait. In one of the four decentralised MCH-FP clinics, a Family Welfare Visitor (FWV) discusses to-day's issue with village women.



In Torkey (Block C), the Matlab MCH-FP Project sub-centre clinic is located in a Government Health building, and shared with the Government Health staff.

with the women of their village (see Chapter 17), and expand their contraceptive use coverage (see below).

During the first four years of the project, the CHWs were involved mainly in family planning services.

In terms of maternal health, they gave nutritional advice to pregnant and lactating women, administered tetanus toxoid shots to pregnant women, and distributed iron and folic acid tablets during pregnancy and lactation. As regards infant and child care, they gave advice to mothers on nutrition and breast feeding, and instructed them in preparing oral rehydration solution.

In 1982 two major changes were introduced into the project:

1. The MCH-FP Extension Project was created to study operational issues regarding replication in a government context (Phillips, *et al.*, 1984a) (see Chapter 22)

2. A larger role was given to MCH services in one half (two operational blocks) of the treatment area, to examine the extent to which they would enhance contraceptive use and further decrease fertility (Phillips, *et al.*, 1984b, Degraff, *et al.*, 1986). There was a conflicting hypothesis to be tested here, in that the addition of non-family planning components to the CHWs' workload might in fact have an adverse effect on the efficacy of the family planning programme.

CONTINUED...
Family Planning and Maternal and Child Health Services

In the two blocks A and C designed as "intensive MCH", the CHWs provided tetanus toxoid immunization to all married women of reproductive age (as opposed to pregnant women only), measles vaccination to all children from nine months to five years, antenatal care, including the distribution of safe delivery kits, to pregnant women.

They also trained traditional birth attendants, and arranged for home insertion and removal of intra-uterine devices. In the two other blocks, B and D, designed as "limited MCH", the CHWs delivered the same services as in the preceding phase.

1.3. Third Phase: The Maternal and Child Health and Family Planning Project

From 1986, there was a major thrust in the development of MCH services integrated with family planning services in the four blocks of the treatment area. The rationale behind this thrust, called the MCH-FP Project, being that the MCH services provided before had been modest in number, coverage, and quality, and that there was a need to vastly improve these services in order to bring about further declines in mortality and in fertility.

Another objective of this project was to show that the family planning field workers were capable of handling more duties than family planning alone, and that extra responsibilities might in fact improve both their relationship with the community and their performance. Finally, the introduction of other MCH services, each with their own record-keeping systems, was meant to give opportunities for the scientific testing and evaluation of various components of the child survival strategy in the particular environment of rural Bangladesh.

As often as possible, these new MCH services were implemented in phases and according to a controlled design. These included:

- ☐ complete immunisation against the six (6) EPI diseases, started in 1986 (see Chapters 8 and 11 for a more detailed discussion),

- ☐ a community-based maternity care programme involving midwives posted in the field, started in 1987 (see Chapter 7),

- ☐ control of acute respiratory infections, started in 1988, (see Chapter 10)

- Vitamin A supplementation, started in 1986,
- nutrition rehabilitation, started in 1986, and
- control of dysenteric diarrhoea in the community, started in 1989.

Four of these new services were of a curative nature: maternity care, control of acute respiratory infections, nutritional rehabilitation, and control of dysenteric diarrhoea.

They relied on the CHWs, after undergoing additional training, to detect cases needing special care, to assess their severity, and then depending on severity, either to manage cases in the home or refer them to the clinic. Central support was necessary to ensure training and supervision, upgrade the Matlab MCH clinic, and supervise the quality of record-keeping.

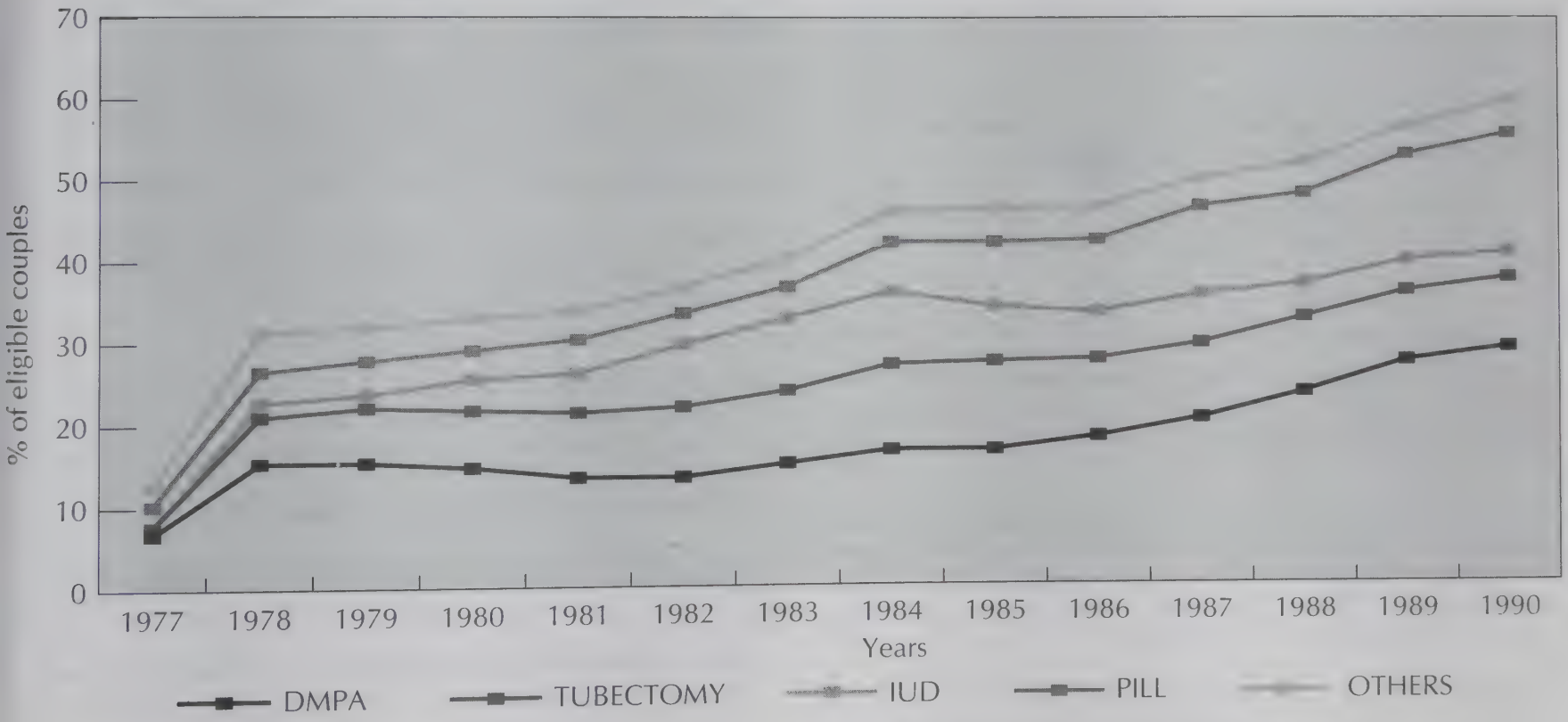


Fig 1: Contraceptive Use Prevalence Rate by Method (Cumulative)
Matlab MCH-FP Project, 1977-90

CONTINUED...
Family Planning and Maternal and Child Health Services

2. METHODS OF EVALUATION AND RESULTS

The division of the study area was the start of the most important study undertaken in Matlab, a study design which is still operating 15 years later.

According to this design, the effect of the programme was to be assessed by comparing service use (process) and demographic indicators (outcome) between the treatment area and the neighbouring comparison area (D'Souza, 1990).

In addition to quantitative methods, such as service recording and demographic surveillance, the programme was monitored and evaluated using qualitative methods, such as anthropological interviews and focus group discussions (Nag, 1989; Simmons, 1988). An economic evaluation was also carried out (Balk, *et al.*, 1988; Simmons, *et al.*, 1991, see Chapters 20-21).

In this section, methods of evaluating the programme and results regarding contraceptive use, fertility and mortality will be examined in turn.

2.1. Contraceptive use

Service use is measured by the **Contraceptive use Prevalence Rate (CPR)**, defined as the ratio of couples using a contraceptive method to the total number of couples of reproductive age living in the area.

Each CHW maintains a service record book containing information about contraceptive use, pregnancies, and MCH services delivered (see Chapter 4). CPR has been monitored monthly in the treatment area since 1977 (Bhatia, *et al.*, 1980; Bhatia, *et al.*, 1983). The trend is shown in Figure 1, previous page.

CPR rose from 7 to 21 per cent of eligible couples in the first 3 months, and thereafter increased more slowly but steadily to reach 33 per cent after 18 months. By the end of the first year, 80 per cent of the initial acceptors were still continuing to practise.

After a plateau during three years, CPR continued to increase from 1982 to 1984. Another rising phase was observed from 1986 onwards, corresponding to the intensification of MCH services, and reached 60 per cent in 1990.

Figure 1 also indicates the trends of specific contraceptive use by method. Injectable long-acting progesterone (DMPA) has been the leading method from the start of the programme, and more so since 1986, when it was responsible for 50 per cent of all contraceptive use.

The intra-uterine devices were on the rise up to the year 1984 (Rob, *et al.*, 1987), when they started to lose ground. At the same time, oral pill gained popularity, and shared with DMPA the responsibility for overall CPR increase from 1985 onwards.

This clearly demonstrated the need to space pregnancies by using *temporary, easily reversible methods* (Koenig, *et al.*, 1987; Khan, *et al.*, 1989).

In addition to monthly monitoring of CPR, four cross-sectional CPR surveys have been carried out during the 15-year period, three of them in both treatment and comparison areas:

- **one in 1975, the baseline survey (Bhatia, 1983);**
- **one in 1977, in the treatment area only** (Bhatia, *et al.*, 1980);
- **one in 1984, in both treatment and comparison areas** (Koenig, *et al.*, 1987; Khan, *et al.*, 1989);
- **and the last one in 1990, in both areas, called the KAP survey:** (Koenig, *et al.*, 1992).

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Family Planning and Maternal and Child Health Services

The main results of these surveys are shown in Tables 1 (below) and 2 (overleaf), while a full discussion in found in Chapter 5.

2.2. Fertility

Demographic surveillance procedures are identical in both areas, thus allowing a controlled evaluation of the demographic impact of interventions introduced in the treatment area (see Chapter 4).

Crude birth rates (births per 1,000 population) in the period from 1978 to 1990 are shown in Figure 2 (page 97). Following inception of the family planning programme in 1978, birth rates in the programme area became consistently and significantly lower than in the comparison area.

Overall fertility rates for the two areas have been computed annually since 1977, and are presented in Figure 3, page 98 (Phillips, *et al.*, 1982; ICDDR,B, 1992).

It must be first noted that the pre-programme levels of **total fertility rate (TFR)** were similar in both areas and were well below the maximum biologically feasible. This fact may be attributed in a large part to long birth intervals, which in turn may be attributed to prolonged breast feeding (Menken & Phillips, 1990).

TFR started to decline in the programme area soon after the inception of the programme, and continued to decline throughout the following years, dropping to 3.5 in 1990.

In the comparison area, TFR declined as well, but remained 33 per cent higher on average than in the programme area, dropping to 5.2 in 1990.

TABLE 1

Contraceptive use prevalence rates (CUPRs) by area in four surveys (per cent of women aged 15 to 44 years in the 1975, 1977, and 1984 surveys; per cent of women aged 15 to 49 years in the 1990 survey).

	1975	1977	1984	1990
CPR Treatment Area:	4.7	23.6	38.9	57.1
CPR Comparison Area:	4.7	N. A.	16.5	27.2
CPR among women who want no more children, T. Area:	N.A.	45.6	49.0	70.7
CPR among women who want no more children, C. Area:	N.A.	N.A.	24.4	37.1
CPR among women who want more children (spacers) T. Area	N.A.	6.8	26.3	42.2
CPR among women who want more children (spacers) C. Area:	N.A.	N.A.	4.6	15.0

N.A.= Not Available

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Family Planning and Maternal and Child Health Services

TABLE 2

Contraceptive use by methods, Matlab treatment and comparison areas, 1984 and 1990 surveys.

Methods	1984				1990			
	Treatment		Comparison		Treatment		Comparison	
	users	all	users	all	users	all	users	all
Modern methods	93.7	36.3	75.9	12.6	94.1	53.8	74.0	20
Tubectomy	24.4	9.5	49.5	8.2	14.8	8.5	34.8	9.5
Vasectomy	1.1	0.4	2.0	0.3	0.6	0.4	0.9	0.2
Injectable	37.4	14.5	2.7	0.4	49.8	28.4	4.1	1.1
Oral pill	7.9	3.1	5.1	0.8	21.1	12.1	29.9	8.1
IUD	20.4	7.9	13.9	2.3	6.2	3.5	2.4	0.6
Condom	2.1	0.8	2.7	0.4	1.4	0.8	1.5	0.4
Foam/jelly	0.4	0.1	0.0	0.0	0.2	0.1	0.4	0.1
Traditional methods	6.3	2.5	24.1	4.0	5.7	3.3	26.0	7.2
Rhythm	2.9	1.1	11.2	1.8	2.6	1.1	13.6	3.1
Withdrawal	1.6	0.6	2.7	0.4	1.4	1.1	4.7	1.7
Other (herbal)	1.8	0.7	10.2	1.7	1.7	1.1	7.7	2.4
All methods users	100	38.8	100	16.5	100	57.1	100	27.2
Non-users		61.2		83.5		42.9		72.8
N=	1102	2840	295	1784	2418	4238	1009	3708

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2.3. Mortality

2.3.1. Infant and child mortality

The effect of the Matlab family planning programme on infant and child mortality was first investigated by Chen, *et al.* (1983). Reviewing the differences in crude death rate and infant mortality rate between treatment and comparison areas during the first three years of the FPHS Project, they found a positive effect: from the end of the first year, mortality became and remained consistently lower in the programme area than in the comparison area. They hypothesized that the family planning programme may induce this result through several possible mechanisms: a change in age structure of the population, a change in the pattern and composition of births according to associated risk factors, a change in nutritional patterns (prolonged breast feeding, improved maternal nutrition, increased availability of resources divided among fewer family members).

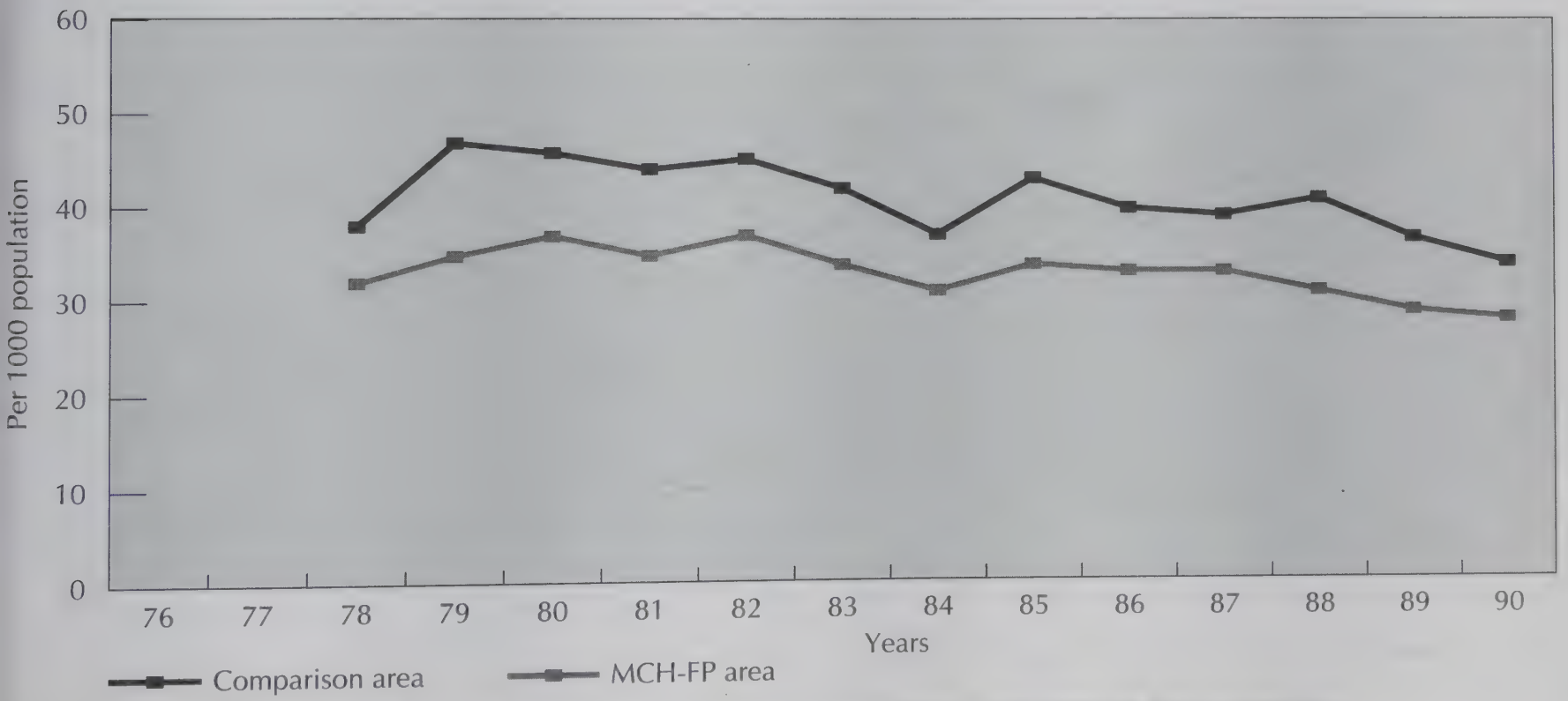

Fig 2: Crude Birth Rates in Matlab comparison and MCH-FP areas, 1976-90

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Family Planning and Maternal and Child Health Services

They also acknowledged a possible role of other health services, such as tetanus vaccination and promotion of oral rehydration therapy, on infant and child mortality.

Following Bongaarts (1987), Chowdhury (1987) and Nahar, *et al.* (1987) suggested that the positive effect of the family planning programme on infant mortality could in fact have been offset by a shift in the distribution of births: an effective family planning programme might have in fact led to a decrease in births among lower-risk, mid-aged, multiparous women, and an increase in births among higher-risk, young, nulliparous women, thereby spuriously increasing the infant mortality rate per 1,000 live-births.

Actual infant mortality rates, however, did not show an increase, such as the above-predicted one, therefore raising the suspicion that other factors might have to be considered.

Briend, *et al.* (see Chapter 12) looked at the impact of family planning on child survival using a retrospective (case-control) design.

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Family Planning and Maternal and Child Health Services

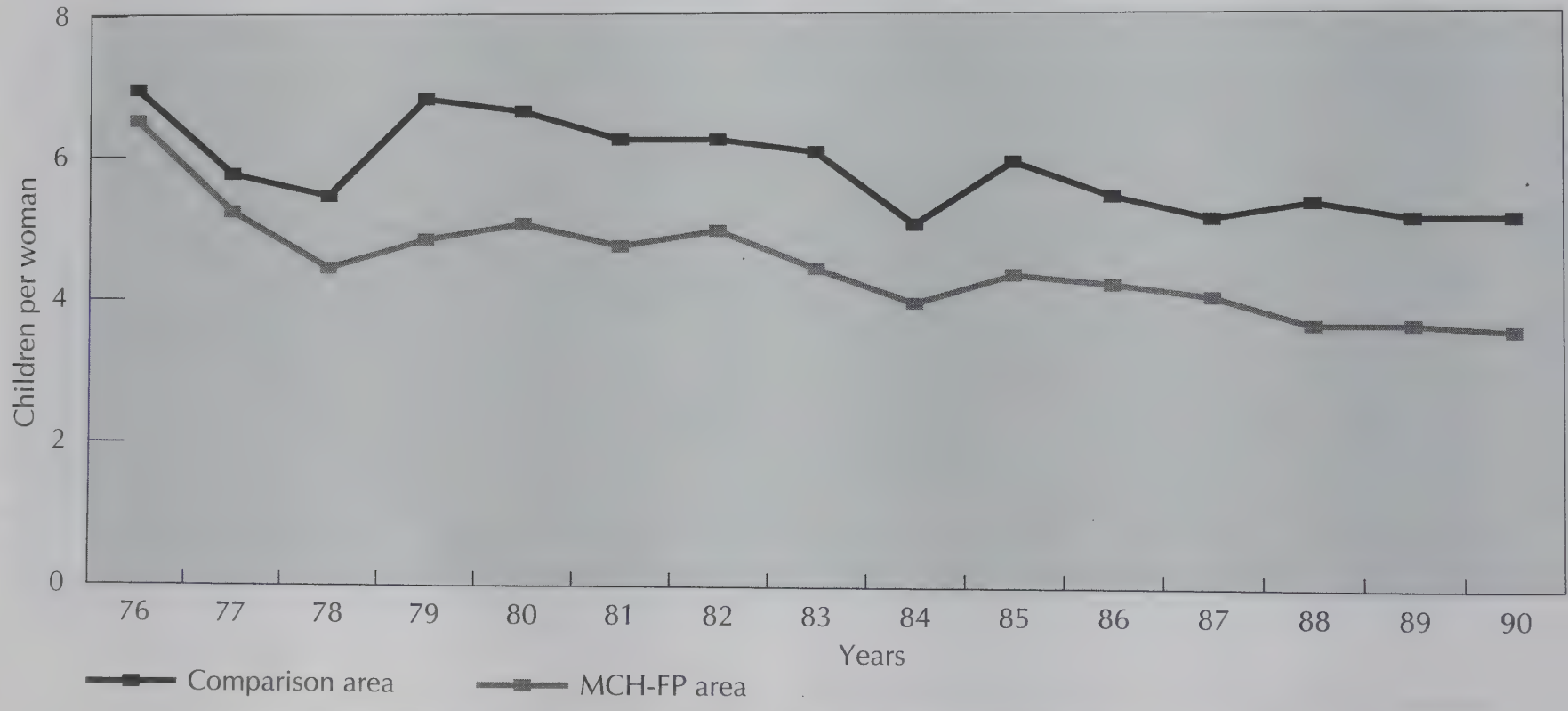


Fig 3: Total Fertility Rates in Matlab comparison and MCH-FP areas, 1976-1990

They concluded that mothers of children who died were less likely to use contraception than mothers of children who survived, but that this association was present only among women who were breast feeding.

2.3.2. Perinatal mortality

The effect of the Matlab FPHSP on perinatal mortality was examined by Fauveau, *et al.* (1990). They found a reduced perinatal mortality rate in the project area relative to the comparison area. However, they attributed this effect to health interventions, such as tetanus immunization and antenatal care, rather than to the family planning component itself (Chapter 8).

2.3.3. Maternal mortality and adult female mortality

Reviewing the trends in maternal mortality in Matlab from 1976 to 1985, Koenig, *et al.* (1988) reported significantly lower maternal mortality rates (per 100,000 women) in the MCH-FP area than in the comparison area after the start of the family planning programme.

They attributed this difference to a decrease in pregnancies rather than to a lower risk of death from maternity-related complications. Maternal mortality ratios (per 1,000 live-births) were in fact not significantly different in the two areas, indicating an equivalent risk of death due to risks of pregnancy.

Again, the family planning programme may have induced a shift in the distribution of births away from a high-risk group of older, high parity women to a higher-risk group of young, first parity women.

Fauveau, *et al.* (1988), analysing adult female mortality rates in Matlab during the same period, confirmed that the lower rates observed in the MCH-FP area during the years following the start of the family planning programme were attributable to lower numbers of pregnancies, and therefore lower risks of pregnancy-related deaths.

3. MANAGEMENT ISSUES

The efficacy of an MCH-FP programme depends on its management. Strong management has characterized the Matlab programme since its inception. The key components of the programme from a managerial viewpoint will be described in three sections: programme management, staff management, and community management.

3.1. Programme management

3.1.1. Project conception

The Matlab Family Planning-Health Services Project (FPHSP) and its successor, the Matlab Maternal and Child Health-Family Planning (MCH-FP) Project, have resulted from rigorous and methodical preparation.

New ideas usually germinated during discussions in Matlab or in universities abroad, or during analysis of preliminary surveys, but plans were always discussed and developed in Dhaka at a high level in the hierarchy. Feasibility, funding and potential benefits were the crucial points to take into consideration.

New programmes were always treated as research issues, and therefore submitted to the two review committees: the Scientific Review Committee and the Ethical Review Committee.

Both committees were composed of competent and renowned individuals from inside and outside the ICDDR,B. Representatives of donor institutions were not members of these committees, and so they could not influence scientific decisions.

Relations with interested donors were initiated at the phase of project conception, but it was only after the final approval of the research protocol that the project was officially transmitted to the donor for funding. In population-related projects, which are always slow to produce results, emphasis was put on mid- and long-term funding commitments.

CONTINUED...
Family Planning and Maternal and Child Health Services

As a result, the various Matlab family planning projects were funded by only four donors during the 16-year period form 1975 to 1990. Donors were always kept regularly informed of the progress and results of the project, and changes were implemented only after approval by the relevant donor(s).

3.1. 2. Organization

Between the investigators on one side and the executing team of field workers and supervisors on the other, the manager is the pivotal person in the Matlab project. In particular, the manager had to keep a certain degree of independence vis-a-vis the successive investigators. The reasons for this were two-fold: first to ensure the continuity of the project, use the lessons of past experience; and second to maintain the balance between the investigators' sometimes impractical requirements and the programme capacity. The manager, however, was always included in the scientific discussions, in the interpretation of findings, and in all publications concerning the project.

The role of supervisors is another key to successful field work. In the Matlab project, there are two lines of supervision for the community health workers and other field staff: administrative and technical. Administrative supervision is ensured by the male senior health assistants and the field research officers.

CONTINUED...
Family Planning and Maternal and Child Health Services

Technical supervision is ensured by the female family welfare visitors, who have received 18 months of formal training in MCH and FP in a government school, and the project medical officers, who also graduated from government schools of medicine.

In addition, there is a special line of supervision for data collection and coding. All the supervisors are in turn supervised by the manager and attend the same biweekly meetings in the subcentres, so they know exactly what other supervisors do.

Since the Matlab field station has been in operation for 25 years, most supervisors have been selected from the pool of field workers. Therefore they have personal experience of the problems encountered during field work.

In the more recent phases of the project, there have been occasional breaks in this practice and young supervisors have been hired from outside. This has caused conflicts due to lack of confidence on the part of field workers. In all cases, however, it was demanded that the supervisors reside in the village where they work, thereby increasing their accountability to the community.

Since they belong to the community, field supervisors in Matlab are expected to know their staff personally, to pay occasional visits to their homes and meet the members of their family, and to be aware of possible social or health problems that might interfere with the conduct of the work.

3.1.3. Transport

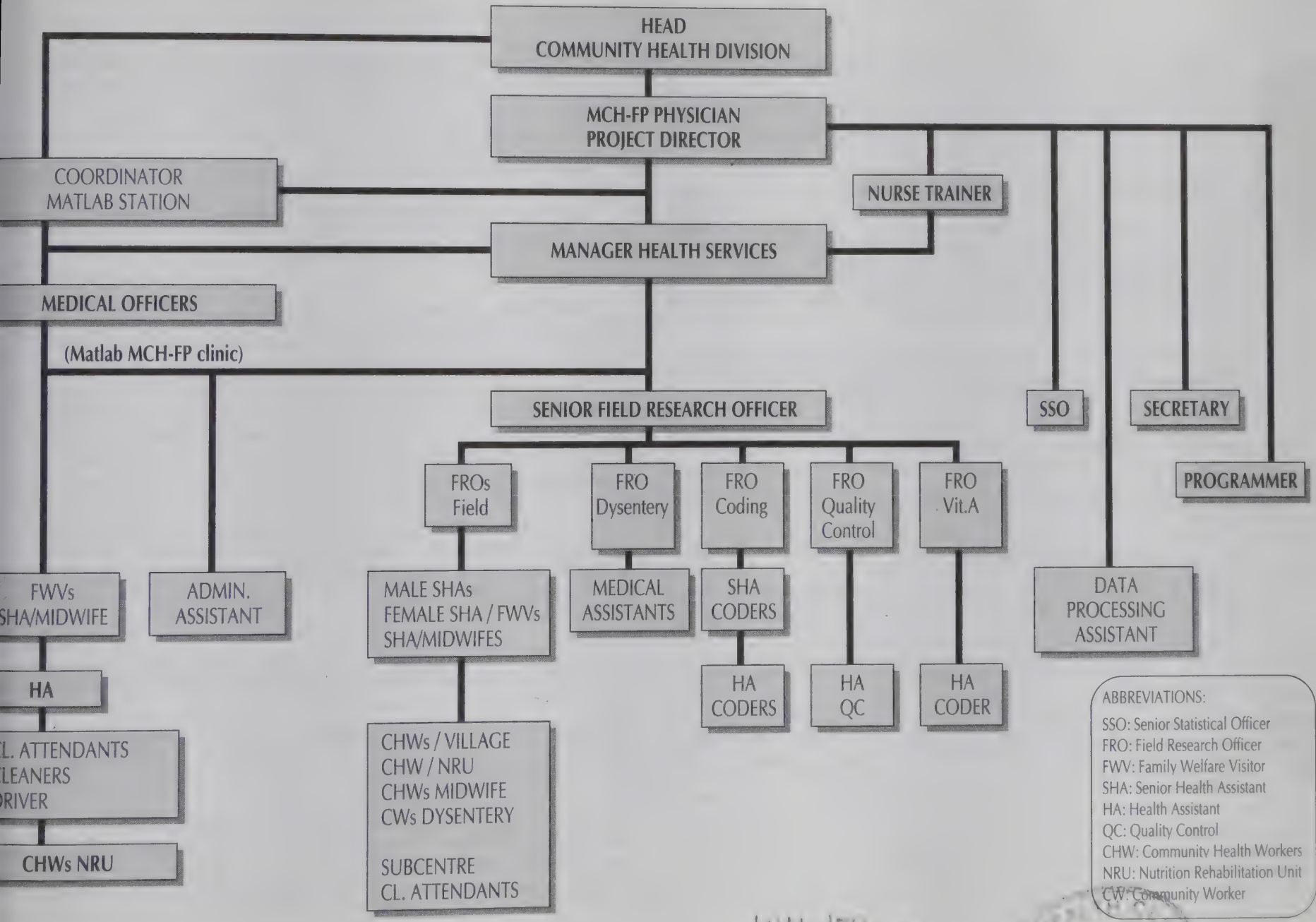
In view of the communication problems due to the geographic particularities of the Matlab area, efforts have been made to provide fast and easy transport for field workers and their supervisors.

Community health workers still have to walk from *bari* to *bari* for most of their household rounds, but during the monsoon they have a country boat and a boatman. On immunization days, porters bring them the vaccine carriers containing vaccines and supplies, and return unused supplies the same day to the Matlab clinic. Supervisors use speedboats to go to distant villages and to attend meetings in subcentres or in Matlab.

The speedboats are shared with the supervisors of other projects (demographic surveillance, cholera vaccine trials, various studies), so that costs are kept as low as possible.

ORGANOGRAMME MATLAB MCH-FP PROJECT 1989

(including MCH-FP, Maternity Care, ARI Control & Vit. A projects)



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Speedboats are also used to transport patients in an emergency and clients referred from the field to the Matlab clinic. The smooth operation of a fleet of 15 to 18 speedboats, however, requires a high level of organization and involves a substantial cost.

3.1.4. Supplies

From the beginning the Matlab project was guided by a "politic of supplies" (see section 1, page 90 of this chapter). Attention has always been given to providing field workers and their clients with enough supplies to meet the demand, and to delivering these supplies as close to the home as possible.

Again the successful operation of such a commitment requires a professional level of organization, accounting and logistics.

Advance projections have to be made, as well as provision for unexpected delays. This is particularly important when some supplies, such as contraceptives or vitamin A capsules, are provided through government channels, which are often irregular.

3.1.5. Record-keeping system

From the beginning of the project it was recognized that a proper system of record keeping is a key element of management: Couple Registration Books were introduced in the first year, with the primary objective that they should serve as management tools.

Over the years, another objective developed, which was that they should serve as a research tool. The system is described in detail in Chapter 4. Original features of the project record-keeping system include:

- flexibility: the format and content of the service record books have changed over time, keeping only the same basic features allowing for longitudinal consistency;
- possibility of linkage with the demographic surveillance system by use of a common individual identification number;
- close supervision;
- close relationship between service providers and coders;
- rapid use of the data collected for feedback to supervisors and field workers.

3.2. Staff management

In order to maintain his authority, the manager must apply staff rules equitably and without yielding to pressure from any side. As seen above, the recruitment of field staff, CHWs and first level supervisors is done in the village where the worker is to operate. The procedure involves local advertising, establishment of a short list based on qualifications, personal interview by a board of senior supervisors, and the signing of a temporary employment contract.

Upon successful completion of a probationary period, the worker is offered a fixed-term contract, either according to the duration of the specific project for which he/she is employed, or on a yearly basis. Annual salary increments are granted after formal job reviews.

For senior supervisors or for qualified jobs for which local candidates cannot be found, the recruitment process follows the same path but is conducted in the ICDDR,B central office in Dhaka. In the case of competing candidates with equivalent qualifications, priority is given to the "internal" candidates, thus offering them a chance of internal promotion.

The salaries of the project field workers are similar to those of the government workers with equivalent qualifications and duties, and follow the same adjustments according to national recommendations. All the project workers involved in research

CONTINUED...
Family Planning and Maternal and Child Health Services

activities, however, receive a small premium. The salaries of project supervisors and doctors are higher than those of their government counterparts because they have research responsibilities, long working days and no opportunities for private earnings.

The initial training of newly recruited CHWs consists of a six-week orientation period in the central MCH-FP clinic, with frequent field visits with senior workers in order to learn the basics.

Subsequent training is ensured on the spot by supervisors during their visits, or during the bi-weekly meetings at the subcentres. In cases where unsatisfactory performance is reported by supervisors or assessed through record review during the annual staff evaluation, or in the case of proven misbehaviour, a warning is issued by the manager.

Termination of employment is ultimately decided if performance does not improve or the misbehaviour persists. Other causes of job termination include migration, serious health problems, or personal convenience. Twelve years after the inception of the project, seventy per cent of the CHWs initially hired were still in place.

4. Community management

Maintaining good relations with the community is a key to maintaining the smooth operation of the project. Frequent visits to villages, meetings with village leaders, discussions with influential people, settling of conflicts through negotiation and compromise are all duties of the manager and senior supervisors.

Effective management also means fair enquiry in the case of a mistake made by a staff member, appropriate action toward culpable staff, rehabilitation of incriminated staff if wrongly accused, and show of support to the project staff.

As outlined in Chapter 17, the project met many problems initially with the recruitment of local women to become CHWs. The nature of the job and the corresponding breach of *"purdah"* seemed unacceptable to the community leaders and conservative elements for several years, until it was realised that the economic benefits and gains in status were considerable.

Another aspect of community management is the relationship with provincial and district authorities: often civil servants are not originally from the area and tend to move to other posts after a short time. Frequent visits to the authorities are necessary to keep them informed and to maintain the continuity of the project. ■

CONTINUED...
Family Planning and Maternal and Child Health Services

The nature of the job and the corresponding breach of purdah seemed unacceptable to the community leaders and conservative elements for several years, until it was realised that the economic benefits and gains in status were considerable.

CHAPTER 6

Family Planning and Maternal and Child Health Services in Matlab

Vincent Fauveau & Jyotsnamoy Chakraborty

Lessons learned...

The hypothesis of the Matlab FPHSP, namely that the provision and delivery of a broad range of contraceptives accompanied by the careful monitoring of side-effects and the provision of basic MCH services would induce and sustain a high contraceptive use and decrease fertility, was somewhat verified. Some of the specific lessons learned during this phase are outlined below:

* *There is a substantial demand for fertility control methods among all social classes and all age groups in Bangladesh. There seems to be no significant difference in demand between treatment and comparison areas.*

* *There is a demand not only for contraceptives but also for care of side-effects, the possibility of switching methods, and for good quality curative services in the case of complications arising from contraceptive use or any other disease of mothers or children.*

* *Supply is a crucial component of a family planning programme, not only regular supply of contraceptives, but also supply of equipment, medicines, and facilities for clinical methods, such as sterilization and intra-uterine devices. The policy of supply, one of the most important features of the Matlab family planning programme, is probably the main factor influencing the difference in contraceptive use between the Matlab and Government programme areas.*

* *A well-supervised, consumer-oriented family planning programme can reduce considerably the constraints on contraceptive use: not only physical and health constraints but also psychic, social, and monetary constraints.*

* *Contraceptives are most likely to be used if they are delivered to the home. Home delivery requires regular visits by community health workers, and, therefore, an appropriate ratio of workers per head of population. One visit to each household every month is considered an optimum, while one visit every three months is the absolute minimum. One worker is, therefore, required per 3,000 population.*

* *When offered a choice of contraceptive methods, women living in the programme area have an overall preference for injectable contraceptives, followed by oral pills and intra-uterine devices, and lastly surgical sterilization. In the*

government programme areas, there was no choice initially and women were offered surgical sterilization as the only method (Note: recently the government family planning programme has started to offer a choice of contraceptive methods).

* *At the beginning of the programme, most contraceptive users were family limiters, that is couples who wanted no more children and were ready to use long-term or permanent methods. Later in the programme, there was a shift away from limiters to spacers, couples who wanted to delay the next pregnancy and were more likely to use short-term, temporary methods (pill, injectables). Spacers were generally found to be less compliant, and have low continuation rates and high failure rates.*

* *The complex level of individual care offered by the programme requires a carefully-kept service record system, as well as a high level of technical supervision and back-up.*

* *Family planning field workers are more likely to gain the confidence of the community if they also respond to other health problems, particularly for those of women and children. Despite the absence of impact demonstrated by statistical analyses, the benefits of integrating quality health services into a family planning programme justify the heavy inputs.*

* *Fertility and mortality among infants and mothers started to decline in the programme area soon after the introduction of the programme, and continued to decrease throughout the following years. The impact of the Matlab family planning programme on mortality, however, is not as straightforward to interpret as its impact on fertility.*

* *The successful operation of such a large and multifaceted project as Matlab requires a professional level of organization, in the hands of a competent manager. This applies for staff management, logistics and supplies, and relations with the community.*

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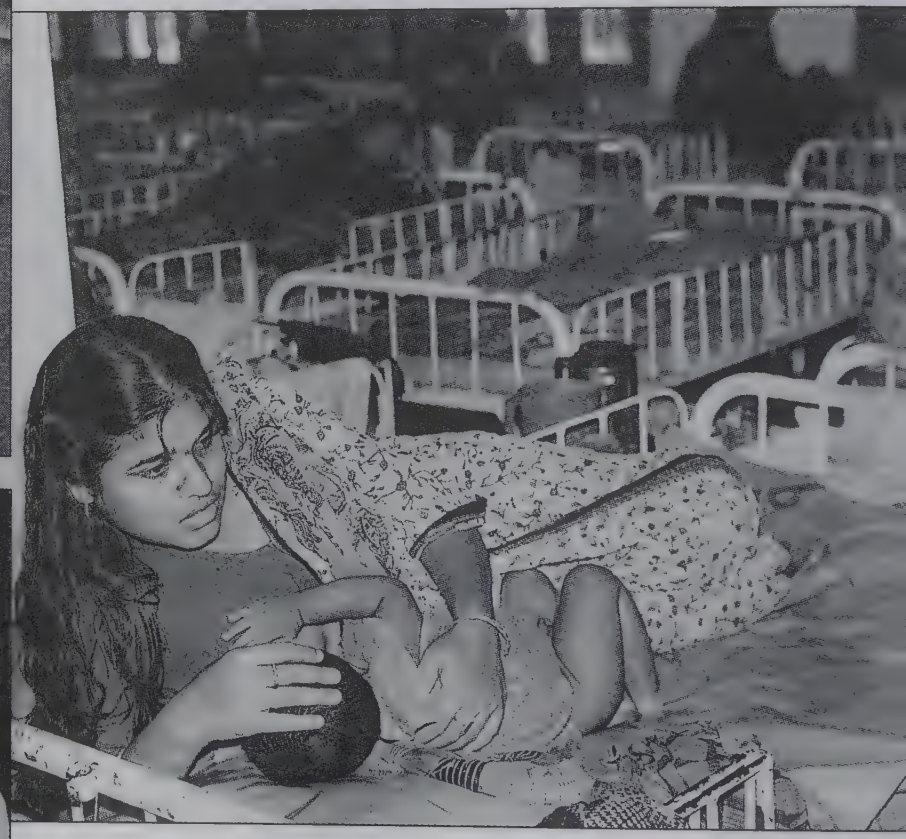

The impact of family planning and improved materna
child care has had its impact in Matlab. More and
women have faith in the benefits of family planning a
average Matlab family is more compact than ever before

CHAPTER 7

Women's Health and Maternity Care in Matlab

Vincent Fauveau
Jyotsnamoy Chakraborty

In this chapter is reviewed the knowledge acquired in Matlab in a traditionally neglected field: women's health. This includes women of reproductive age, that is between 15 and 44 years of age. There are of course women younger than 15 and older than 44 years who menstruate, use contraceptives, get pregnant, or breast-feed their child, but they account for a minority. A broadening of the age span for studying women's health, say from 13 to 49 years, would result in a proportional over-representation of women not exposed to the risk of conception.

Reproductive age starts with the first menstrual period or menarche, relatively easy to identify, and terminates with menopause, a far more imprecise event. It is generally accepted that the mean age at menarche in a community is inversely related to the nutritional status of women in this community, while the mean age at menopause is positively related (Marshall and Tanner, 1986).

A study conducted in Matlab in 1975-77 indicated a mean age at menarche of 15.8 years (Chowdhury, *et al.*, 1977; Foster, *et al.*, 1986). However, it was hypothesized that this relatively high age was the result of a recent increase due to famine, flood and war in the preceding years. Body weight was found to be the most important determinant of onset of menarche.

Another study based on the same data reported a mean age at menopause of 43.6 years, and confirmed that thinner and lighter (but not shorter) women has an earlier menopause, while fatter and heavier (bu ot taller) women had a later menopause (Karim, *et al.*, 1985).

In Matlab as much as in the rest of the country, marriage is almost universal, with nearly 80 per cent of women already married by the age of 20 years in 1977 (Chowdhury, *et al.*, 1977).

From the same study it was estimated that 26 per cent of women in the age group 10 to 19 years were ever married , in contrast with 98 per cent in the age group 20 to 29 years (Chowdhury and Becker, 1981).

The mean age at first marriage increased from 17.1 years in 1977 to 17.7 years in 1982, and 18.8 years in 1985 (Table 1, overleaf). The practice of polygyny is rare.

Part II

General fertility rate (GFR) and total fertility rate (TFR) decreased over the period between 1977 and 1985 in the whole study area, with a decrease of greater magnitude in the MCH-FP area than in the comparison area (Table 1, below).

It must be noted that a somewhat similar decrease has also been observed in the comparison area in subsequent years (data not shown), in relation with the intensification of family planning services in the government programme.

TABLE 1

Reproductive characteristics of women in Matlab, 1977-85

	1977	1982	1985
Mean age at menarche (yrs):	15.8	-	-
Mean age at first marriage:	17.1	17.7	18.8
Mean age at first conception:	18.3	19.5	20.3
Mean age at menopause:	43.6	-	-
Women ever married at age 15:	31%	-	-
Women ever married at age 20:	77%	-	-
General Fertility Rate (15-49 yrs):	208	174	164
GFR in comparison area:	-	192	185
GFR in MCH-FP area:	-	156	144
Total Fertility Rate (per woman):	6.7	5.6	5.0
TFR in comparison area:	-	6.3	6.0
TFR in MCH-FP area:	-	5.0	4.5
Crude Birth Rate (per 1,000 pop.):	46.4	40.7	38.4
CBR in comparison area:	47.2	44.6	42.5
CBR in MCH-FP area:	44.2	36.9	34.3

CONTINUED...
Women's Health and Maternity Care

Talking about female reproductive issues is not considered appropriate in rural Bangladeshi society, especially in the presence of unmarried or newly married women (Lindenbaum, 1968; Lindenbaum, 1975; Maloney, *et al.*, 1981a and 1981b; Aziz, *et al.*, 1985). There is a cultural perception that issues related to the female genital tract are matters of shame, and that physical contact with genital blood and other secretions are polluting (Blanchet, 1984).

Between themselves, however, women exchange their experiences and feelings very freely, particularly within the *"bari"* or compound. This free circulation of information is an advantage, from the viewpoint of collecting information based on interviews, provided interviews are conducted by women with women. A typical example is the collaborative recall effort made by a group of women when visited in their *bari* by a female interviewer to collect details of events and symptoms preceding a maternal death.

In this chapter the issues related to women's health in Matlab are first addressed, with a review of mortality and morbidity, and efforts to improve them. Then specific issues of maternal mortality and morbidity are discussed, with emphasis on the maternity care programme. Lessons learned and remaining questions to be investigated are discussed at the end of each of these two sections.

1. WOMEN'S HEALTH (not focusing on maternity-related problems)

1.1. EPIDEMIOLOGY

1.1.1. Adult female mortality

A retrospective study of adult female mortality from 1976 to 1985 was conducted in 1986-87 (Koenig, *et al.*, 1988; Fauveau, *et al.*, 1988c; Fauveau, *et al.*, 1989a).

This study involved a review of 1,039 death forms and a reinterview for about 75 per cent of them. A trained female health assistant re-interviewed relatives in their homes for deaths of women in the comparison area, and community health workers for deaths in the MCH-FP area. Relatives were also interviewed in the MCH-FP area for deaths which occurred *before* the start of the project in November 1977, and for cases not attended by community health workers.

One of the purposes of this effort was to collect more accurate and consistent information and to detect "hidden" maternal deaths which would otherwise have gone unnoticed, mostly because pregnancy was undeclared.

The cause of death was assigned by the principal investigator, according to the procedure described in chapter 5. Table 2 (overleaf) shows the distribution, by cause and by area, of adult female deaths that occurred in Matlab between 1976 and 1989.

Of a total of 1,440 deaths, one third were due to infectious diseases (excluding obstetric infectious diseases), but this is a low estimate since a large portion of the 261 (18 per cent) deaths due to causes impossible to specify were probably also due to infectious causes.

One quarter of all deaths were due to direct obstetric complications (see part B below for details), and 13 per cent to injuries. None of the broad categories of cause of death were significantly different, in rates or in proportions, between the two areas.

A significantly lower rate of direct obstetric death rate was reported in a previous analysis (Fauveau, *et al.*, 1988c), but that analysis focused on the years 1978-85, excluding the baseline years 1976-77, during which very few obstetric deaths were reported in the comparison area.

Table 3 (overleaf) shows the distribution of adult female deaths by cause and by age. As expected, there was a trend of increasing death rates due to infectious and non-infectious diseases with increasing age, and a trend of decreasing death rates due to injuries with increasing age.

Death rates due to direct obstetric causes were lower both in young and older women than in women in the middle of their reproductive age span.

The most dramatic difference between two consecutive age groups was in the rate of deaths from suicide. This observation is discussed in detail in Fauveau, *et al.* (1989b).

1.1.2. Women's health: nutritional status

Compared with mortality, nutritional issues and morbidity among women of reproductive age have received less attention in Matlab. Yet they are key determinants of women's health and they also influence pregnancy outcome and child health.

Rural Bangladeshi women are generally considered as chronically malnourished, meaning that their mean weight is lower than that of a reference population (Huffman, *et al.*, 1985; Ford, *et al.*, 1988). Newborn girls are small (small in comparison with the reference population and also smaller than boys (Fauveau, *et al.*, 1990).

Female children are disadvantaged within the family, in terms of a smaller share of nutrients and care, resulting in a lower nutritional status and higher overall and specific mortality (Bairagi, *et al.*, 1982; Chen, *et al.*, 1981; Bhuiya, *et al.*, 1986; Koenig, *et al.*, 1986; Fauveau, *et al.*, 1990).

Educational attainment (attendance at school and years of school attended) is also lower in girls than boys. As a result, adolescent girls enter their reproductive life with a handicap.

Early pregnancy, particularly before the end of their growth and combined with feeding restrictions, contribute to loss of the growth of long bones and pelvic bones.

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Women's Health and Maternity Care

TABLE 2

Distribution of causes of death among women aged 15 to 44 years. Matlab Comparison and MCH-FP areas, 1976-1989.

CAUSE OF DEATH	Whole area			Comparison area			MCH-FP area		
	N	%	Rate	N	%	Rate	N	%	Rate
INFECTIOUS DISEASES	**475**	**33.0**	**85**	**239**	**32.1**	**89**	**236**	**34.0**	**82**
Acute watery diarrhoea	46	3.2	8	18	2.4	7	28	4.0	10
Acute dysentery	39	2.7	7	13	1.7	5	26	3.7	9
Chronic persistent diarrhoea	65	4.5	12	40	5.4	15	25	3.6	9
Acute respiratory infection	18	1.3	3	12	1.6	4	6	0.9	2
Chronic respiratory infection	109	7.6	20	65	8.7	24	44	6.3	15
Fever/septicaemia	90	6.3	16	49	6.6	18	41	5.9	14
Hepatitis	65	4.5	12	24	3.2	9	41	5.9	14
Other infectious diseases	43	3.0	8	18	2.4	7	25	3.6	9
DIRECT OBSTETRIC CAUSES	**371**	**25.8**	**67**	**204**	**27.4**	**76**	**167**	**24.0**	**85**
Abortion	95	6.6	17	52	7.0	19	43	6.2	15
Postpartum sepsis	33	2.3	6	21	2.8	8	12	1.7	4
Postpartum haemorrhage	93	6.5	17	48	6.4	18	45	6.5	16
Toxaemia/Eclampsia	61	4.2	11	35	4.7	13	26	3.7	9
Obstructed labour	29	2.0	5	16	2.1	6	13	1.9	5
Other obstetric	60	4.2	11	32	4.3	12	28	4.0	10
INJURIES	**187**	**13.0**	**34**	**94**	**12.6**	**35**	**93**	**13.4**	**32**
Drowning	6	0.4	1	4	0.5	1	2	0.3	1
Snake-bite	14	1.0	3	9	1.2	3	5	0.7	2
Other accidents	66	4.6	12	37	5.0	14	29	4.2	10
Intentional/suicide	74	5.1	13	37	5.0	14	37	5.3	13
Intentional/homicide	27	1.9	5	7	0.9	3	20	2.9	7
NON-INFECTIOUS DISEASES	**114**	**7.9**	**20**	**63**	**8.5**	**23**	**51**	**7.3**	**18**
IATROGENIC CAUSES	**32**	**2.2**	**6**	**19**	**2.6**	**7**	**13**	**1.9**	**5**
IMPOSSIBLE TO SPECIFY	261	18.1	47	126	16.9	47	135	19.4	47
Diseases with oedema	107	7.4	19	60	8.1	22	47	6.8	16
Others	154	10.7	28	66	8.9	25	88	12.7	30
ALL CAUSES	**1440**	**100.0**	**258**	**745**	**100.0**	**277**	**695**	**100.0**	**241**
Women/years			**557,798**			**268,915**			**288,883**

TABLE 3

Age distribution of causes of death among women aged 15 to 44 years Matlab whole study area, 1976-1989.

CAUSE OF DEATH	Numbers			Per cent distribution			Rates		
	15-24y	25-34y	35-44y	15-24y	25-34y	35-44y	15-24y	25-34y	35-44y
INFECTIOUS DISEASES	**185**	**124**	**166**	**30.6**	**30.4**	**38.9**	**68**	**80**	**127**
Acute watery diarrhoea	16	16	14	2.6	3.9	3.3	6	10	11
Acute dysentery	13	6	20	2.1	1.5	4.7	5	4	15
Chronic persistent diarrhoea	17	25	23	2.8	6.1	5.4	6	16	18
Acute respiratory infection	10	4	4	1.7	1.0	0.9	4	3	3
Chronic respiratory infection	26	30	53	4.3	7.4	12.4	10	19	41
Fever/septicaemia	46	20	24	7.6	4.9	5.6	17	13	18
Hepatitis	36	20	9	6.0	4.9	2.1	13	13	7
Other infectious diseases	21	3	19	3.5	0.7	4.4	8	2	15
DIRECT OBSTETRIC CAUSES	**168**	**124**	**79**	**27.8**	**30.4**	**18.5**	**62**	**80**	**60**
Abortion	31	32	32	5.1	7.8	7.5	11	21	24
Postpartum sepsis	13	15	5	2.1	3.7	1.2	5	10	4
Postpartum haemorrhage	37	33	23	6.1	8.1	5.4	14	21	18
Toxaemia/Eclampsia	43	15	3	7.1	3.7	0.7	16	10	2
Obstructed labour	13	8	8	2.1	2.0	1.9	5	5	6
Other obstetric	31	21	8	5.1	5.1	1.9	11	14	6
INJURIES	**125**	**41**	**21**	**20.7**	**10.0**	**4.9**	**46**	**27**	**16**
Drowning	5	1	0	0.8	0.2	0.0	2	1	0
Snake-bite	10	3	1	1.7	0.7	0.2	4	2	1
Other accidents	35	19	12	5.8	4.7	2.8	13	12	9
Intentional /suicide	59	12	3	9.8	2.9	0.7	22	8	2
Intentional /homicide	16	6	5	2.6	1.5	1.2	6	4	4
NON-INFECTIOUS DISEASES	**19**	**41**	**54**	**3.1**	**10.0**	**12.6**	**7**	**27**	**41**
IATROGENIC CAUSES	**15**	**6**	**11**	**2.5**	**1.5**	**2.6**	**5**	**4**	**8**
IMPOSSIBLE TO SPECIFY	**93**	**72**	**96**	**16.4**	**17.6**	**22.5**	**34**	**47**	**73**
Diseases with oedema	39	28	40	6.4	6.9	9.4	14	18	31
Others	54	44	56	8.9	10.8	13.1	20	29	43
ALL CAUSES	605	408	427	100.0	100.0	100.0	222	265	327
Per cent of all deaths:	**42%**	**28%**	**30%**						
Women/years:							**272890**	**154130**	**130778**

In Matlab, women have learned to meet and speak openly about their health problems, including fertility and contraception.

Communication is the key to the progress of the Matlab MCH-FP Project.

This, in turn, contributes to producing small babies or to having delivery problems (at equal parity, obstructed labour is more common among young than older mothers).

Limited or non-use of contraception until attainment of socially desired family size (two boys and one or two girls, see Koenig, *et al.*, 1987), leads to short birth intervals and a strain on maternal resources.

Socio-cultural restrictions on movements of young women outside their homes and disregard for their complaints contribute to a general lack of attention to their health status and limited care provision in case of disease.

Access to and use of modern medical care prior to death did not exceed 25 per cent of adult female deaths in the Matlab comparison area between 1978 and 1985, and did not increase over time (Fauveau, *et al.* 1988c).

The Birth Interval Dynamics Study (BIDS), carried out between October 1975 and January 1980 on 2,445 women in 14 villages (Huffman, *et al.*, 1985 and Ford, *et al.*, 1988), released information on nutritional status of non-pregnant and pregnant women, summarized in Table 4 (below).

This study also reported seasonal variations in weight and arm-circumference. There seems to be a beneficial period with weight gains, from November till July, followed by weight losses from August till October. This pattern corresponds with seasonal variations of rice availability, rice price, wage rates, and agricultural workload.

More recently, within the maternity care project implemented since mid-1987 in 28 villages of the Matlab MCH-FP area, anthropometric data were collected cross-sectionally among 1,633 pregnant women examined at some point between the third

TABLE 4

Anthropometry among pregnant and non-pregnant women in Matlab, 1975-80 and 1987-89

	Birth Interval Dynamics Study 1975-80		Maternity Care Project 1987-89
MEAN (sd) MEASURES	Non-Pregnant **(n=2161)**	After pregnancy termination **(n=884)**	Pregnant at 6.8 months **(n=1,633)**
Height in cm:	147.9 (5.2)	147.9 (5.1)	149.7 (5.5)
Weight in kg:	40.4 (4.6)	41.0 (4.5)	45.8 (5.2)
Arm-circumference in mm:	218 (17)	-	217 (18)
Pregnancy weight gain:	5.0 (*)		
Hematocrit in per cent:	35.1 (3.6)		

** Except for women who conceived during May or June, whose mean pregnancy weight gain was 2.7 kg only (Pebley, et al., 1985)*

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and ninth month of pregnancy (on the average at 6.8 months, Table 4). These women represented 33 per cent of all pregnant women in the project area, and were not selected for particular pregnancy-related problems. Their mean height was almost 2 cm higher than the mean height of women measured 10 years earlier, but their mean arm-circumference was not greater.

1.1.3. Nutritional anaemia

No published studies have reported haemoglobin levels among adult women in Matlab. Huffman, *et al.* (1985) reported a mean haematocrit of 35 per cent among non-pregnant women, 10 per cent short of the value commonly accepted as normal.

They also reported a lower mean haematocrit level in September-October, parallel to other anthropometric indicators, suggesting seasonal variations of nutritional status.

Also found was an inverse correlation of haematocrit and maternal age, suggesting a worsening of nutritional status with age, in support of the "maternal depletion" hypothesis.

Another haematocrit survey, conducted in 1985 on 808 non-pregnant and 344 pregnant or lactating women, reported 47 per cent of the former and 50 per cent of the latter with haematocrit values below the WHO-recommended standards, versus 33 per cent of adult males (Alam, unpublished).

A field-clinic-based haemoglobin survey, using the Reichert-Jung haemoglobinometer (colorimetry technique) on a sample of 122 non-pregnant women, revealed a mean value of 10.5 g/dl. Twenty per cent of these women had a haemoglobin level below 10 g/dl (Jagdeo, 1990).

As part of the Maternity Care Project conducted in 1987-89, anaemia, detected and assessed by midwives during 2,216 antenatal visits through examination of the lower conjunctive, is reflected in the following illustration:

+++ in 0.1 per cent of all women examined,
++ in 3.1 per cent,
+ in 92.3 per cent,
negative in 4.5 per cent.

It must be noted that all pregnant and fully lactating women in the MCH-FP area, where the last 2 surveys were performed, have been offered a course of 200 mg of ferrous fumarate and 1 mg of folic acid daily since 1978. In 1986, this treatment was reinforced and doses were augmented to 400 mg of ferrous fumarate and 2 mg of folic acid daily. No scientific assessment of compliance with this indiscriminate preventive treatment, and no outcome evaluation have been performed yet.

1.1.4. Infectious morbidity

No survey of infectious morbidity among women has been performed in the Comparison area.

However, in the MCH-FP area, attention to health and family planning-related complaints has been promoted since 1978. Paramedical staff (Lady Family Planning Visitors (LFPVs) and Family Welfare Visitors (FWVs) were trained to examine patients and treat them at their daily MCH-FP clinics in each block subcentre, and records were kept of all contacts between patients and health providers.

Focusing on reproductive tract infections among non-users and users of contraception in the MCH-FP area in 1985, Wasserheit, *et al.* (1989) reported surprisingly low-prevalence rates of symptoms of reproductive tract infection and of confirmed reproductive tract infections among non-users.

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Among users, prevalence rates varied by contraceptive method, with low figures among hormonal-method users (oral pill and injectable progestin) and high figures among intrauterine-device users and tubectomised women (Table 5, overleaf, taken from Wasserheit, *et al.*, 1989).

Pelvic infection was uncommon among users and not found among non-users. Cervical infection was most frequent among IUD users.

Vaginal infection was the most frequent site of infection among all groups, and particularly among IUD users and tubectomised women.

The same pattern was observed for a group of lower tract infections with a potential to ascend into the upper tract.

Sexually transmitted infections (due to N. gonorrhoea, C. trachomatis, or T. vaginalis) were rare.

These findings are low estimates, given the fact that:

i) many women might have been reluctant to report intimate symptoms,

ii) only women reporting symptoms were examined,

iii) not all women reporting symptoms accepted examination, and

iv) the germs responsible for sexually transmissible diseases are difficult to isolate.

1.2. INTERVENTIONS

Provision of health care services to mothers has been included in the Matlab Family Planning-Health Services Project since its inception in October 1977. The aim was to sustain and increase contraceptive use among married women (Bhatia, *et al.* 1980).

Eighty female village workers, later known as community health workers (CHWs), were recruited and trained to motivate and counsel women about family planning, to deliver various contraceptive methods at the doorstep (or refer for clinical methods), and to manage side effects.

The CHWs were also trained to guide mothers about proper nutrition and hygiene during pregnancy and the postpartum period, to distribute iron-folic acid tablets to pregnant and lactating women, to immunize pregnant women against tetanus, and to refer serious cases to clinics at subcentres.

Four MCH-FP clinics were set up on the periphery, one in each block, with the assistance of community leaders. One female paramedic (Lady Family Planing Visitor or Family Welfare Visitor) and one male Senior Health Assistant were to staff these clinics, which were used as training and administrative centres as well as referral clinics. The female paramedics, with 18 months of formal MCH-FP training, supervised and backed up CHWs in their area, assisted in clinic-based contraceptive intervention (IUD and sterilization), examined and treated patients with complaints at the clinic, and accompanied severely affected patients to the central clinic at Matlab.

There was always a female MCH-FP physician available at Matlab, to examine and treat referred patients, or to refer them further to the district hospital. The beneficial effect on adult female mortality, reported by Fauveau, *et al.* (1988c), was attributed to this Family Planning-Health Services Project; i.e. not only a 57 per cent reduction in obstetric deaths, but also a 22-per cent reduction in deaths due to infectious diseases, and a 13-per cent reduction in deaths due to other causes.

They also reported that the most important part of the mortality reduction observed after the start of the project was observed during the first two years, suggesting that there was an important unmet demand for health services among rural women.

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TABLE 5

Prevalence of symptoms of, and medically confirmed, reproductive tract infections among non-users and users of various contraceptive methods. Family Planning Health Services Project (MCH-FP area), 1985.

	Non-users (n=396)	Hormonal Method users (m=1,255)	IUD users (n=452)	Tubectomized women (n =623)
Prevalence of Symptoms (per cent of all interviewed):	9.1	14.7	33.8	38.4
Confirmed infection (per cent of all examined):	3.5	5.6	21.6	23.5
Pelvic infection:	0	0.3	1.4	2.4
Cervical infection:	1.1	1.7	10.2	4.5
Vaginal infection:	2.9	4.7	17.1	22.1
Lower tract infection with potential for spread to upper tract:	1.6	2.0	10.0	15.9

(Categories are not mutually exclusive, some women had multiple infections.)
(Data from Wasserheit, et al., 1989.)

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2. MATERNAL HEALTH

2.1. EPIDEMIOLOGY

2.1.1. Maternal mortality

A maternal death is defined as the death of a woman while pregnant or within 42 days of termination of pregnancy, from any cause related to or aggravated by the pregnancy or its management, but not from accidental or incidental causes (WHO-ICD9 1979).

The American Medical Association recommends using a 90-day limit after pregnancy termination. It is difficult to ascertain the accidental or incidental nature of many non-obstetric deaths, and particularly to determine whether a non-obstetric cause did not lead to the death precisely because the woman was pregnant. For this reason, following many others, we include all deaths occurring within the time limit, from any cause, in our definition of a maternal death.

Maternal mortality is generally expressed as the **ratio** of maternal deaths to 1,000 live-births over a period of time. Alternatively, it can be expressed as the **rate** of maternal deaths to 10,000 or 100,000 women of reproductive age (generally 15 to 44 years).

This distinction is important because ratio and rate do not express the same risk: the maternal mortality **ratio** expresses the risk of dying during pregnancy or the postpartum period, once pregnant, while the maternal mortality **rate** expresses the risk of dying during reproductive-aged life (once entering reproductive age).

The former is a function of the level of maternity care, while the latter is a function of both family planning and maternity care.

The first studies of maternal mortality carried out in Matlab in 1967-68 and 1968-70 were reported by Chen, *et al.* (1974). Using the broad definition of maternal death as any death of a woman during pregnancy or within 90 days of its termination, they reported maternal mortality ratios of 7.7 and 5.7 per 1,000 live-births, respectively, (7.1 and 4.9 if they had used the more restrictive current definition).

Other studies carried out in other places in Bangladesh also reported high figures, ranging from 5.1 to 6.2 per 1,000 live-births (Rochat, *et al.*, 1981, Lindpainter, *et al.*, 1982, Khan, et al., 1986; Alauddin, 1986).

More recently, a large retrospective study covering the years 1976 to 1985 was carried out in Matlab by Koenig, *et al.* (1988). All 1,037 death records of women who died between 15 and 44 years of age during the 10-year period were reviewed, and re-interviews of relatives and field workers were performed for most of them.

The purposes of this study were: to detect pregnancy-related deaths which had not been reported as such previously by the demographic surveillance system; to obtain more detailed information for assessing the cause of death; and to examine the trends of maternal mortality in relation to the Family Planning-Health Services Project introduced in the MCH-FP area in 1978.

Using the same extended definition as Chen, *et al.* (1974), a total of 387 maternal deaths were identified, leading to a maternal mortality ratio of 5.5 per 1,000 live-births and a maternal mortality rate of 101 per 100,000 women aged 15-44 years. Only 1 maternal death was reported before the age of 15 years and 2 after the age of 44 years.

If the 20 deaths that occurred between 42 and 90 days after pregnancy termination were not accounted for, the ratio would be 5.2 per 1,000 live-births, and the rate 95 per 100,000 women aged 15-44 years.

We use this restricted definition throughout the remainder of this chapter. Figures using the 90 days definition can be found in Koenig, *et al.* (1988) and Fauveau, *et al.* (1988a).

Maternal deaths accounted for 35 per cent of all adult female deaths. Thirty-seven per cent of all maternal deaths occurred during pregnancy (including 19 per cent due to abortion), 16 per cent during labour, and 22 per cent within 48 hours of the delivery.

One half of all maternal deaths occurred in women aged less than 25 years, and one third to nulligravidas. Maternal mortality ratios followed the classical U-shaped relationship with both maternal age and gravidity (Figure 1, overleaf).

An estimation of cumulative risks of dying from complication of pregnancy or delivery, provided by the same study, indicated that 1 per cent of women were at risk of dying from complications associated with their first live-birth, 3 per cent from complications associated with their sixth live-birth, and 7 per cent from complications associated with their eleventh live-birth.

A concomitant study of risk factors for maternal mortality, using a case-control approach, identified some strong risk factors:

- ☐ age less than 20 years with a first parity;
- ☐ age more than 34 years with any parity;
- ☐ previous birth interval more than 48 months and
- ☐ age more than 34 years; and, previous birth interval less than 24 months.

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Table 6 (facing page) shows aggregate figures of adult female death rates and maternal mortality rates and ratios during the 14-year period from 1976 to 1989, by area.

Figure 2 (overleaf) shows the trends of maternal mortality rates and ratios during the same period.

Three distinct periods seem to appear from the examination of the trends of maternal mortality rates: an initial period (1976 to 1978) during which the rates were roughly similar, a middle period (1979 to 1986) during which rates in the comparison area were consistently greater than in the MCH-FP area, and a more recent period (1987 to 1989) during which rates in the two areas were again similar.

Maternal mortality ratios, on the other hand, were never significantly different in the two areas, and a substantial decline was even observed in the comparison area after 1985, the ratio becoming consistently lower than in the MCH-FP area after 1986, in spite of the implementation of the Maternity Care Programme in one half of the MCH-FP area.

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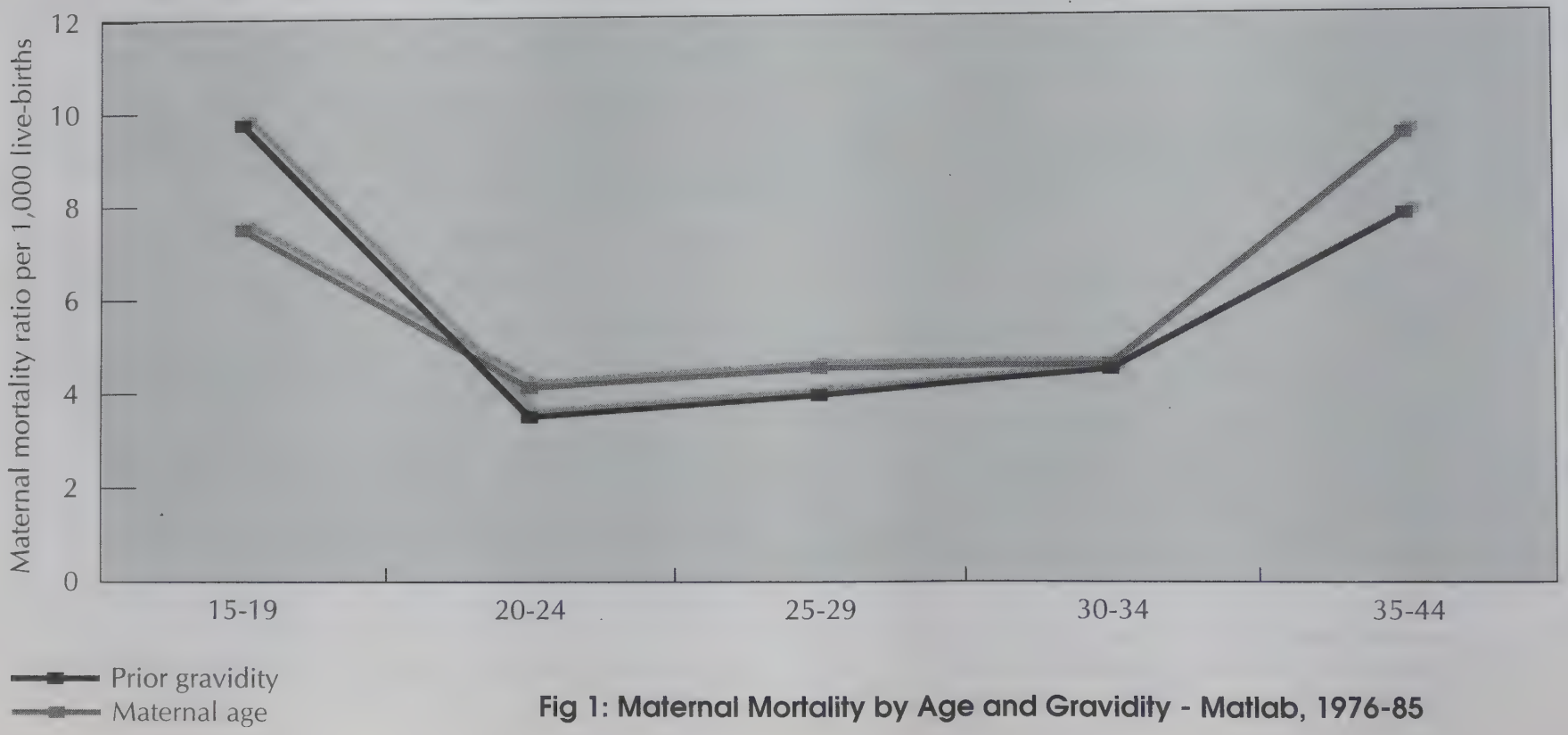

Fig 1: Maternal Mortality by Age and Gravidity - Matlab, 1976-85

As detailed in Koenig, *et al.* (1988), one explanation for these findings lies in the effect of the family planning programme on fertility and on the risk of becoming pregnant, another explanation lies in the shift in the distribution of child-bearing away from one high risk group (high parity) into another high risk group (primiparity). The explanation for the drop in maternal mortality ratios in the comparison area since 1986 is not clear and requires more research.

The causes of maternal deaths that occurred between 1976 and 1989, assessed by the verbal autopsy method described in chapter 3, are shown in Table 7(overleaf). Of 508 maternal deaths (using the WHO-recommended definition), 73 per cent were due to direct obstetric causes, 23 per cent to concomitant causes, i.e. causes that were initiated outside of the genital tract, but were aggravated by the pregnancy or the postpartum status. Four per cent of the deaths were due to causes impossible to specify.

The examination of maternal mortality ratios by cause, age, and parity (Fig 2, overleaf) suggests that parity seems a stronger determinant of direct obstetric causes, while age seems to be a stronger determinant of concomitant causes. Excluding abortion-

TABLE 6

Adult female and maternal death rates and ratios, Matlab MCH-FP and Comparison area, 1976-89.
(Maternal deaths = during pregnancy or within 42 days of its termination, from any cause).

	MCH-FP area	Comparison area	All
POPULATION:			
Reproductive age woman/years	288,883	268,915	557,798
Live births:	44.946	54.653	99.599
DEATHS:			
Women 15-44 years:	689	751	1,440
Maternal deaths (% of above):	229 (33%)	279 (37%)	508 (35%)
Induced abortion (% of above):	38 (17%)	43 (15%)	81 (16%)
DEATH RATES (PER 100,000):			
Women 15-44 years:	238.5	279.3	258.2
Maternal deaths:	79.3	103.8	91.1
Induced abortion:	13.2	16.0	14.5
RATIOS (PER 1000 LIVE-BIRTHS):			
Maternal mortality:	5.1	5.1	5.1
Induced abortion:	0.8	0.8	0.8

CONTINUED...
Women's Health and Maternity Care

TABLE 7

Causes of maternal deaths, Matlab 1976-1989.

N= Number of cases % = Proportionate mortality rate (per cent distribution)
Rate = Cause-specific mortality rate, per 100,000 women 15-44 years Ratio = ratio per 1,000 live-births

CAUSE OF DEATH	RATES/RATIOS, ALL WOMEN				RATIOS BY PARITY		
	n	%	Rate	Ratio	0	1-6	7+
N			557798	99599	20897	68974	9728
% of all live-births			100.0		21.0	69.3	9.7
DIRECT OBSTETRIC	371	73.0	66.5	3.7	6.7	2.5	5.7
Abortion: spontaneous	14	2.8	2.5	0.1	0.1	0.1	0.3
Abortion induced	81	15.9	14.5	0.8	1.3	0.5	1.7
Complications. of pregnancy	28	5.5	5.0	0.3	0.6	0.2	0.2
Toxaemia/eclampsia	61	12.0	10.9	0.6	1.8	0.3	0.0
Obstructed labour	29	5.7	5.2	0.3	0.5	0.2	0.7
Postpartum haemorrhage.	93	18.3	16.7	0.9	1.1	0.7	2.1
Postpartum sepsis	33	6.5	5.9	0.3	0.9	0.2	0.2
Other postpartum	32	6.3	5.7	0.3	0.4	0.3	0.4
CONCOMITANT	116	22.8	20.8	1.2	2.2	0.9	0.9
Digestive tract	57	11.2	10.2	0.6	1.0	0.5	0.4
Cardio respiratory	13	2.6	2.3	0.1	0.0	0.1	0.3
Injuries, violence	46	9.1	8.2	0.5	1.2	0.3	0.2
UNSPECIFIED	21	4.1	3.8	0.2	0.3	0.2	0.2
ALL CAUSES	508	100.0	91.1	5.1	9.2	3.6	6.8
% of all maternal deaths	100				38	49	13

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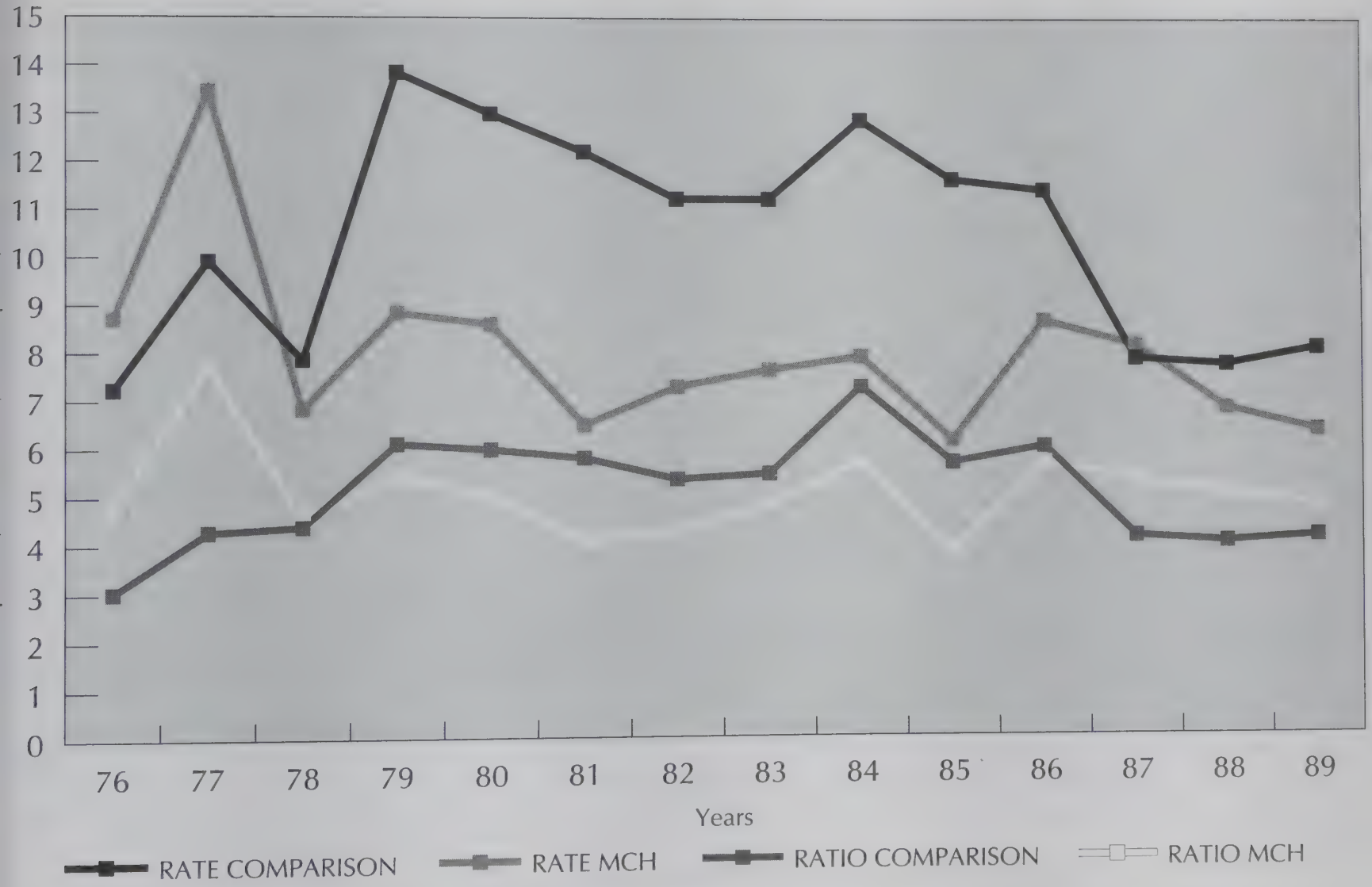

Fig 2: Maternal Mortality Rates and Ratios
MATLAB MCH-FP AND COMPARISON AREAS, 1976-89

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related deaths, as many as 55 (19 per cent of all maternal deaths) occurred during labour (prior to delivery), 83 (28 per cent) occurred within 48 hours of delivery, 95 (32 per cent) from 3 to 42 days after delivery (Figure 3, facing page).

The distribution of maternal deaths by cause and time relative to delivery indicates that:

- 85 per cent of deaths due to eclampsia occurred during labour or the first 48 hours after delivery,
- 68 per cent of deaths due to postpartum haemorrhage occurred within 48 hours of delivery, and
- 54 per cent of deaths due to sepsis occurred within 2 weeks of delivery.

Abortion:

The incidence of abortion, both spontaneous and induced, is virtually unknown, all estimates being probably lower than actual figures. This is due to the difficulty of assessing pregnancies early, but also to the socio-cultural stigma attached to induced abortion, and its illegal status.

An improvement of the legal status was introduced in 1978 when **"menstrual regulation"** became authorized and practised within government health services. Menstrual regulation refers to a technique of induction of menses by instrumental abrasion and aspiration of the uterine internal lining. Legally, it is considered as "an interim method of establishing non-pregnancy, for a woman at risk of being pregnant, whether or not she is pregnant in fact" (Ali, *et al.*, 1978), and is not regulated by the Penal Code restricting abortion (Dixon-Mueller, 1988).

It is recommended in the case of menstrual delay, but no longer than 10 weeks, and not in women without prior pregnancies. Studies of the conditions under which menstrual regulations were performed, together with evaluations of the national programme, were carried out by the Bangladesh Association for the Prevention of Septic Abortion (BAPSA, Begum, *et al.*, 1987; Amin, et al., 1989). A study of menstrual regulation clients in Matlab was reported by Bhatia and Ruzicka (1980).

Besides studies of abortion and abortion deaths done in other parts of Bangladesh (Rochat, *et al.*, 1981; Measham, *et al.*, 1981; Khan, *et al.*, 1986; Islam, 1982), the large retrospective study of maternal deaths carried out in Matlab in 1985-86 released information on deaths due to abortion (Koenig *et al.*, 1988; Fauveau *et al.*, 1988; Fauveau *et al.*, 1989).

Between 1976 and 1989, there were 14 deaths attributed to spontaneous abortion and 81 attributed to induced abortion in Matlab, yielding spontaneous and induced abortion ratios of 0.1 and 0.8 per 1,000 live-births respectively (Table 7). Of all induced abortion-related deaths, 43 (53 per cent) were reported in the comparison area and 38 (47 per cent) in the MCH-FP area. The mean age at death was 28 years but there were two peaks, one at 19 years, the other one at 36 years.

Of the women who died from complications of an induced abortion, 35 per cent were nulliparous, 65 per cent were married, 27 per cent not yet married, and the rest widows or divorced, 75 per cent died at home, without seeking care from modern medical care, and 31 per cent did not seek care from any practitioner at all.

It is far more difficult to estimate the rates of overall induced abortion regardless of whether it was complicated or not. Based on the estimated death-to-case ratio of 2.4 per cent proposed by Khan, *et al.* (1986), it can be calculated that at least 300 induced abortions are performed each year in the Matlab DSS area.

2. 1. 2. Maternal morbidity

In contrast with maternal mortality, far less is known about morbidity associated with pregnancy and delivery in Matlab.

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Women's Health and Maternity Care

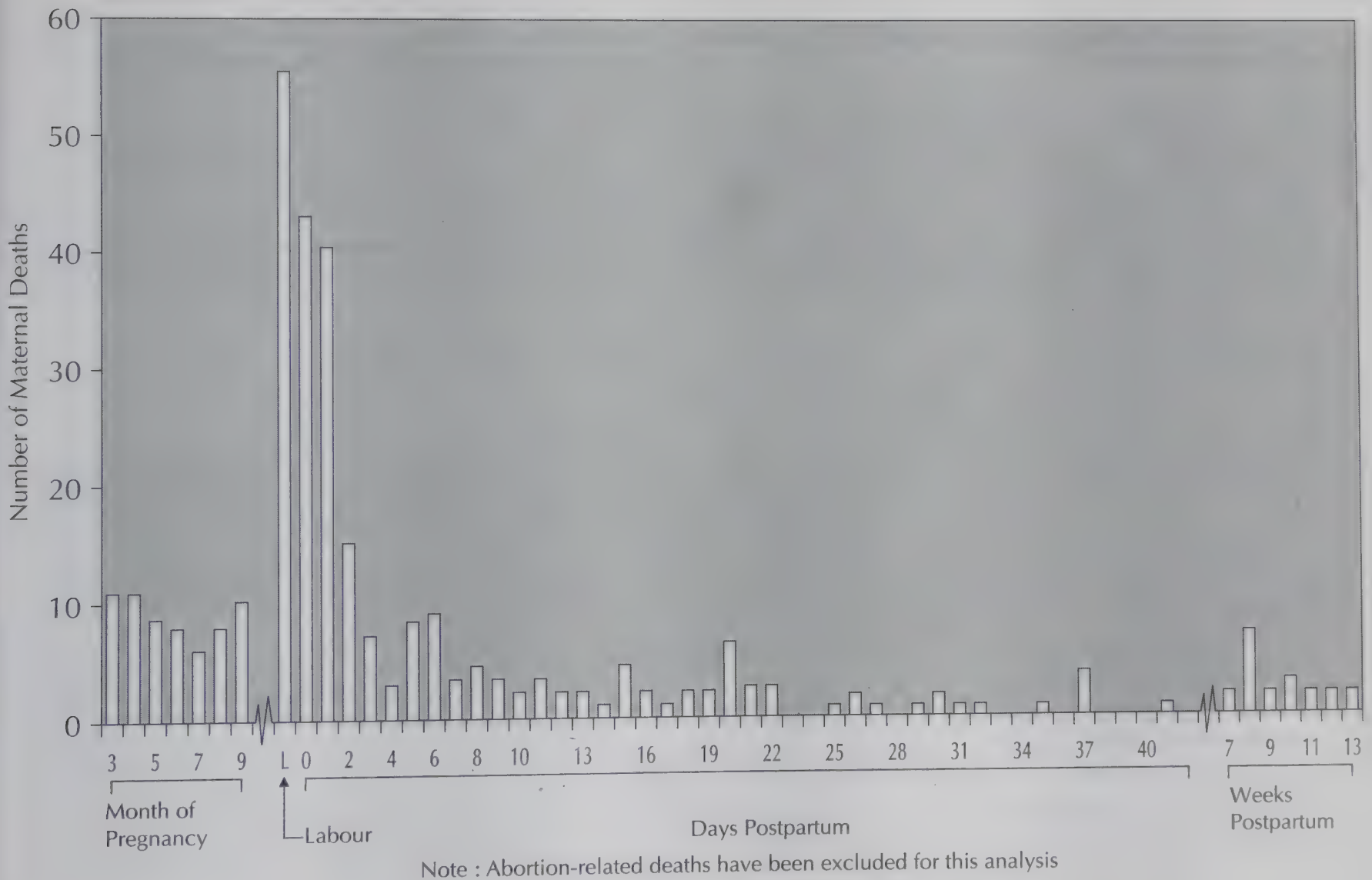

Fig 3: Timing of Maternal Deaths, Matlab, 1976-85

Four areas are of interest: nutrition, anaemia, infectious diseases, and physical disabilities.

Information on nutritional status during pregnancy was provided during the Birth Interval Dynamics Study (1975-80, see above), and the Maternity Care Project (1987-89). As shown in Table 8, (below), the difference in mean weight between women seen before 24 weeks of gestation (mean gestational age=20 weeks) and women seen after 32 weeks (mean gestational age=35 weeks) was 3 kg. The mean heights and mid-upper-arm circumferences of these 2 groups of women were not different.

There was an increase in the proportion of women with severe anaemia (assessed by midwives by conjunctival examination) from the beginning to the end of pregnancy. These differences are not due to seasonal variations because the study covered 3 years.

Information on infectious diseases, including infections of the uro-genital tract, and physical disabilities associated with pregnancy and childbirth has not been collected in the community to date. The project physicians and paramedical workers see women referred by community health workers at the four subcentres and at the central Matlab MCH-FP clinic.

TABLE 8

Nutritional information during pregnancy, Matlab Maternity Care Project, 1987-89.

	Before 24 weeks (n=582)	24 to 32 weeks (n=1016)	Beyond 32 weeks (n=580)
Mean gestation age (wks):	20.4 (3.0)	28.0 (2.3)	35.0 (2.3)
Mean height (cm):	149.7 (5.5)	149.8 (5.5)	149.8 (5.7)
Mean weight (kg):	44.4 (4.8)	46.0 (5.2)	47.4 (5.6)
Mean MUAC * (mm):	216.8 (18)	216.7 (18)	217.3 (18)
% with severe anaemia @:	2.5	2.8	4.6
% with severe tibial oedema @:	0.7	2.3	4.5
% with severe proteinuria @:	0.2	0.7	0.7
% with glycosuria @:	1.5	2.3	1.7
Mean diastolic blood pressure:	68.2 (9)	69.6 (9)	74.2 (11)
Mean systolic blood pressure:	108.2 (11)	109.8 (10)	113.6 (13)

@ : Assessed by nurse-midwives by conjunctival examination, manual examination, and urine dipstick, respectively.
* : MUAC = mid-upper-arm circumference.

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Women's Health and Maternity Care

They have observed chronic genital infections, complications of perineal tears, fistulae, uterine prolapses, but no statistical data are available.

2. 2. INTERVENTIONS

2. 2. 1. The Matlab Maternity Care Project

The findings of the retrospective study of maternal mortality formed the basis for the design of a community-based maternity care project, implemented from April 1987 in one half of the MCH-FP area. These findings include the following:

i) 77 per cent of all maternal deaths were directly related to obstetric complications, most of which would have required attention from skilled health personnel;

ii) excluding abortion, 68 per cent of all direct obstetric deaths occurred during labour or 48 hours following delivery. They would have required on-the-spot clinical examination for early detection and immediate attention for management;

iii) 80 per cent of all maternal deaths occurred at home, far (in travel time) from equipped facilities, while 95 per cent of all deliveries took place at home.

These findings led to the hypothesis that posting professional midwives in villages would have the best potential for saving lives, provided these midwives were equipped to treat obstetric complications at their onset on the spot, and were backed up by an effective chain of referral.

To allow impact evaluation by comparison with a control area, the programme was implemented in one half of the treatment area, comprising approximately 48,000 members of the population living in 39 villages. There were 2 subcentres with one MCH-FP out-patient clinic in each. Two nurse-midwives, (government trained with 3 years of nursing and 1 year of midwifery), were recruited and posted in each subcentre. Their duties were:

i) to train CHWs and traditional birth attendants and ensure their collaboration; ii) to visit pregnant women detected by the CHWs; iii) to assess risks of complications antenatally as much as possible; iv) to make sure that they will be called during labour; v) to attend as many home deliveries as possible; vi) to treat arising complications at their onset before they become too severe; vii) to organize referral and accompany the patient to the central clinic at Matlab if they judge it necessary; and viii) to visit as many parturients as possible within 48 hours of delivery.

Details of their duties, treatment guidelines, essential drugs and equipment, and a record-keeping system are described separately (Fauveau, *et al.*, 1988b).

The focus was on midwives' presence at as many deliveries as possible, for immediate intervention at the onset of a complication, in order to avert passage to a severe condition, almost impossible to treat in this situation.

Examples of recommended feasible timely interventions included early administration of anti-eclamptic drugs, stimulation of labour in case of a prolonged one, external or internal versions, complete evacuation of the uterus in case of a retained or torn placenta, vaginal packing in the case of a cervical tear, stitching in the case of a vaginal tear, infusion of plasma-expanders in case of a haemorrhagic shock, administration of antibiotics to prevent severe infections (this is not to say that all these interventions have been performed commonly in the field).

Interventions for the sake of the newborn were also recommended, such as early clearing of airway, warming, early colostrum feeding, or simple resuscitation procedures.

In support of the midwives, two other components were included in the programme:

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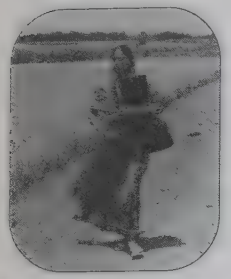

i) the setting up of a referral chain, including a boatman and a helper to accompany patients day or night to the central clinic;

ii) the installation of a maternity clinic at Matlab, where trained paramedics and physicians were always available for intensive surveillance, treatment, or further referral to the district hospital in the case of need for surgery (caesarean section) or blood transfusion.

The midwives maintained a record of all prenatal and postpartum visits performed and all deliveries attended. The outcome of the intervention, however, was measured independently by comparing direct obstetric mortality ratios per thousand live-births between the intervention and control areas during the 3 years before and the 3 years after the start of the programme. Midwives were not involved in the assessment of cause of death.

The results of this trial have been described in Fauveau, *et al.* (1991a). As summarized in Figure 4 (facing page), there was a *significant decrease in the obstetric death ratio* per 1,000 live-births in the programme area (two blocks of the MCH-FP area) after the implementation of the programme, while there was *no such decrease in the control area* (two other blocks of the MCH-FP area).

Comparability of the two areas and similar levels of other health services, including family planning, suggest that the difference observed may be attributed to the programme. In view of the relatively small size and short duration of this study, together with the difficulty of documenting process indicators, caution must be exercised about the replicability of this programme in the rest of the country.

Similarly, the evaluation of costs, in terms of staff and time necessary to visit all pregnant women and as many high risk deliveries as possible, suggest that alternative strategies are to be tested before recommending replication of this programme at a larger scale. In particular, the identification of the minimum package of feasible interventions in the field, the specifications of the referral system, and the capacity of the referral maternity clinics require further study.

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Women's Health and Maternity Care

2.2.2. Screening for high risk pregnancies

Under difficult conditions like those prevailing in rural Bangladesh, where 95 per cent of women deliver at home, not medically assisted, only attended by relatives or traditional birth attendants, it makes sense in maternity care programmes to prioritize assistance to women at the highest risk of complications.

Attempts to identify women with the highest risk of maternal mortality, however, have not been satisfactory so far. Two approaches have been tried, one was prospective, using a score made of a combination of criteria assessed by paramedical field workers, and looking at the outcome after delivery. The other approach was retrospective, using a case-control analysis of risk factors. It seems that the high number of risk factors blurs the emergence of clear and strong factors, and puts virtually all women at an equivalently high risk.

The other crucial question in the risk approach is that of effective preventive or curative interventions to reduce corresponding risks once factors have been identified.

The first attempt to screen pregnant women dates from 1982, when the health services within the Family Planning-Health Services Project (FPHSP) were intensified in one half (Blocks A and C) of the MCH-FP area (see Chapter 6).

Health services offered in the other half (blocks B and D) were to remain at the same level as before, with no particular emphasis on pregnancies. In Blocks A and C, Lady Family Planning Visitors (LFPVs) examined pregnant women on the occasion of their first antenatal visit to one of subcentres. A score, made of

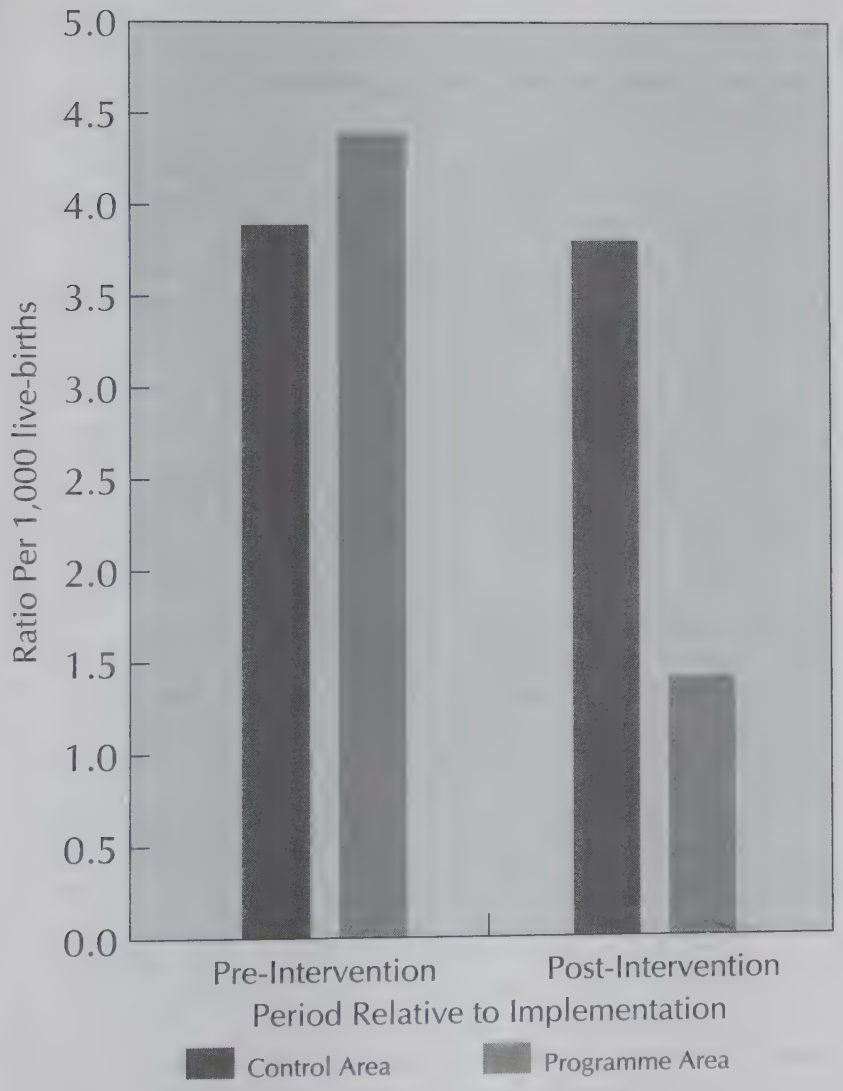

Fig 4: Direct Obstetric Mortality Ratio
Matlab Maternity Care Programme, 1984-89

the combination of 17 subscores corresponding to risk factors, was attributed to each pregnant women.

Unfortunately, no special medical or obstetrical care and no referral system were organized to deal with women assessed as high risk. Action was limited to giving good advice on nutrition and hygiene during pregnancy. As a result of this lack of intervention, however, it was possible to examine the outcome of these pregnancies in relation to their antenatal score, for the mothers as well as for the neonates.

Results of the comparison of the outcomes of high risk (score >30) and low risk (score <30) pregnancies are shown in Table 9 (overleaf).

Women with a high score were on the average older, of higher parity, less educated, and from less well-off families than women with a lower score. They experienced a higher perinatal mortality, more attributable to a higher still-birth ratio than an early neonatal death ratio. They also experienced a higher maternal mortality ratio, but numbers were too small to derive meaningful conclusions.

Some of the limitations concerning replication of this screening method included: i) improper use of the instrument by field workers, ii) selection biases in the choice of women to be examined and scored, iii) a too high number of risk factors taken into account, iv) lack of sensitivity to the method, and v) absence of appropriate intervention(s) to apply in the case of a high score.

Two lessons were derived from this exercise, first the need to use a simpler method, and second the need to tie an intervention to particular screening device, which would be useless otherwise.

The other approach to determine risk factors for maternal mortality was retrospective, looking at the risk of dying from a maternal cause, relative to women who survived, according to

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TABLE 9

Characteristics of women with high and low antenatal risk scores, and outcome of pregnancy. Matlab MCH-FP area, 1983-86.

	Low score <30	High score 30+	All pregnancies 1982-86
TOTAL BIRTHS (excluding miscarriages):	1010	405	17086
Mean age in yrs:	24.5	29.3	
Mean parity:	1.8	2.9	
Mean maternal education (yrs of school attended):	2.2	1.6	
Mean household area in sq ft:	321	301	
Live-births (LB):	987	378	16490
Perinatal deaths, *N:*	55	41	1190
Ratio per 1,000 LB:	55.7	108.5	72.2
Still-births:	23	27	596
Ratio per 1,000 LB:	23.3	71.4	36.1
Early neonatal deaths, *N:*	32	14	594
Ratio per 1,000 LB:	32.4	37.0	36.0
Maternal deaths, *N:*	0	2	80
Ratio per 1,000 LB:	0.000	5.29	4.85

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exposure to bio-demographic factors. Results were reported earlier in this chapter.

It was not possible in this analysis to incorporate socio-economic risk factors (maternal education, education and occupation of household head, household size, income, distance from hospital) or bio-medical factors (nutritional status, anaemia, oedema, antenatal visit findings).

Nor was it possible to assess the prevalence of these risk factors in the community, which would have been necessary to evaluate the attributable risk for each of these factors (Backett, *et al.*, 1984).

2. 2. 3. Training traditional birth attendants or posting midwives in villages? Policy implications.

Much has been written on potential solutions to reduce the burden of maternal mortality and morbidity in disadvantaged communities. Few of these solutions have been implemented, and even fewer have been evaluated. One of the central questions, to improve the quantity and quality of contacts between pregnant women and health personnel, is whether these

contacts should be with professional midwives or trained traditional midwives. The former have technical advantages, being able to handle complicated cases in the field, while the latter have social advantages, being active and respected residents of the community.

The problem is that both need a referral chain, including transport facilities and effective end-points, since many obstetric complications require clinic-based equipment to treat them (vacuum-extractor, caesarean section, oxygen, blood transfusion, resuscitation, symphisiotomy, etc).

Following recommendations from the WHO and other organizations, a programme to train traditional birth attendants (TBAs) had been implemented in Matlab since 1982. Previous observation studies had released anthropologic information on local TBAs (Bhatia, 1981; Islam, *et al.*, 1984; Blanchet, 1984; Fauveau & Chakraborty, 1988).

It is estimated that about 500 TBAs reside in the 70 villages of the MCH-FP area, an average of 7 per village, or 1 per 190 of the population. Two thirds of them attend births regularly, having attended at least 50 since they started their activity. Two thirds are older than 50 years, and 93 per cent are illiterate. Most of them restrict their activity to attending labour and delivery, without any form of antenatal care.

The first sessions of TBA training took place in 1982, but without practical demonstrations. In January 1983, production and distribution of Safe Delivery Kits (SDKs) were begun in the 2 Blocks A and C under the "intensive MCH" programme.

These kits, containing sterile razor blade and thread, soap and cleaning agents, were given to mothers by the CHWs at the beginning of pregnancy. Mothers were instructed to keep them until the onset of labour, when they would give them to the birth attendant to use.

The main purpose of these kits was to allow a safe cutting and dressing of the umbilical cord, thus preventing neonatal tetanus. These kits, however, were introduced at the same time and in the same area as the tetanus toxoid immunization of all married women. Therefore it was not possible to evaluate their efficacy in preventing neonatal tetanus.

The effect of training TBAs on maternal mortality has never been demonstrated. This effect, if any, is not likely to be important in the absence of a complementary intervention in the form of an effective referral system.

However, training of TBAs has been included as an essential component of the Matlab maternity care programme for other reasons:

i) TBAs may be cheap and effective front-line elements to detect and report pregnancies,

ii) if ignored or dismissed, or feeling threatened by potential competitors, TBAs may have a negative influence on the community's acceptance of the programme,

iii) motivated TBAs may contribute in ensuring complete coverage of tetanus toxoid immunization, and thus eradication of neonatal tetanus (Ross, 1986),

iv) through the use of soap, disinfectants, boiled water, nail cutting, clean dressings, TBAs may contribute in reducing maternal and perinatal infectious morbidity (Maglacas & Simons, 1986; Pratinidhi, *et al.*, 1985).

With these potential benefits in view, a second session of TBA training was organised in the first months of 1987, just before the start of the Maternity Care Programme. TBAs were invited to the subcentres for practical demonstrations of handling delivery problems. They received a SDK each, to open and use during the session. And they were introduced to the newly recruited nurse-

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midwives, whom they were asked to consider not as competitors but as second-line assistants in case of need.

It was agreed that, although nurse-midwives will actively visit as many pregnant women as possible, TBAs will still be given priority to assist women at deliveries.

If both were called, the nurse-midwife would observe and intervene only if signs of complications arise, such as pre-eclampsia, malpresentation, obstructed labour, excessive bleeding.

One frequent difficulty in this agreement was found in the overuse of oxytocin injections by TBAs (or by village doctors upon TBA's recommendation), while midwives were asked to refrain from using this drug too often.

An evaluation of this collaborative effort was carried out by Hlady, *et al.* (1990), using a case-control analysis of the use of nurse-midwives during labour and delivery.

They found that women who had sought assistance from midwives during delivery (cases) were younger, better educated, more often primiparous, than a random sample of women who had not called the midwives (controls).

They also found that use of midwives was positively correlated with the number of antenatal visits, and negatively correlated with the distance between patient and provider.

As in other studies carried out in the Subcontinent (Gupta, 1978), it was found that rural women (and their mothers-in-law, who more often made decisions about seeking assistance), valued age, experience, compliance with local customs, and proximity when a choice had to be made between a traditional or professional midwife.

The fact that they also valued skills and the ability to handle complications was a matter of personal interpretation of these qualities. The findings of this study were taken into account when discussing modifications to the maternity care programme in subsequent phases.

An anthropologic approach to the study of perceptions of and reactions to the maternity care programme was carried out by Stark (1990-91), when she spent 8 months in a village of the programme area, observing reproductive practices in relation to the newly introduced programme (see description and findings in Chapter 18).

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Women's Health and Maternity Care

Rural women ... valued age, experience, compliance with local customs, and proximity when a choice had to be made between a traditional or professional midwife.

CHAPTER 7

Women's Health and Maternity Care in Matlab

Vincent Fauveau & Jyotsnamoy Chakraborty

Lessons learned...

Adult female mortality in rural Bangladesh is high, at least higher than in neighbouring countries (India, Thailand).

60,000 women of reproductive age (15-44 years) die each year in Bangladesh, one third of them from infectious diseases, one fourth from obstetric complications, one eighth from injuries.

Socio-cultural constraints, and a reluctance to go to hospital due to lack of confidence, prevent rural Bangladeshi women from seeking care at government hospitals.

One way to address this problem is to deliver care services at the village level, and this implies good supervision and an effective referral system. Also necessary is an improvement in the quality of care at referral hospitals. Female health workers (community health workers, nurse-midwives) are required at the periphery to detect problems, provide first aid, and encourage referral in case of need.

Specifically, since a major part of morbidity and mortality is due to infections, proper antibiotic use at the community level has the potential to reduce the duration and severity of infectious diseases, and to reduce overall mortality.

Levels of maternal mortality in rural Bangladesh are high, as much as 100 times higher than in the most developed countries.

There were no observed downward trends in maternal mortality ratios (per live-births) in Matlab between 1975 and 1988.

Assuming that Matlab is representative of the rest of rural Bangladesh with respect to maternal mortality, about 28,000 maternal deaths are to be expected each year in the country, three-quarters of them from direct obstetric complications, almost 20 per cent from complicated abortion.

Excluding abortion-related deaths, almost 50 per cent of all maternal deaths occur during labour or within 48 hours of delivery.

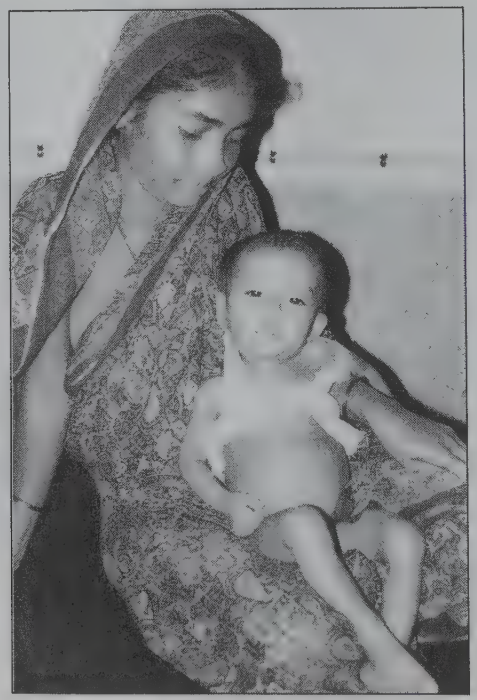
About 50 per cent of all maternal deaths occur in women aged less than 25 years, and 40 per cent in primigravidas.

Use of health services is very limited, since 95 per cent of all deliveries take place in homes, and about 80 per cent of all maternal deaths also occur in homes, without any professional assistance.

Rural Bangladeshi women are chronically malnourished, and do not gain more than 5 kg on the average during pregnancy.

A community-based maternity care programme, involving posting professional midwives in villages and establishing effective referral lines, has been associated with a reduction of obstetric mortality. It seems that the latter component (effective referral system) was the most likely to have lead to the observed impact, but more research is needed to isolate the effect of each component. Another issue to be researched is the question of whether less-skilled workers posted in the villages could have achieved a similar outcome.

Much remains to be learned about replication on a large scale of such a programme, and long term changes in maternal health.



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Known to Matlab children as the "daktarni," CHWs are now held in great respect because of their role in health care.

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Women's Health and Maternity Care

CHAPTER 8

Neonatal and Perinatal Health in Matlab

Vincent Fauveau

PART II

Neonatal and perinatal health are particularly difficult areas to study, because the causes of morbidity and mortality in these age groups are multiple and complex, and because interventions to improve health in these age groups require multiple inputs. Indeed, with the notable exception of maternal tetanus immunization, both the effect of interventions and the measurement of their effect remain uncertain.

Neonatal deaths, that is deaths within the first 4 weeks of life, account for more than half of infant mortality in Matlab (53 to 59 per cent between 1986 and 1990). Neonatal mortality is expressed as the ratio of neonatal deaths per 1,000 live births.

Perinatal deaths comprise stillbirths and deaths within the first week of life (early neonatal deaths). Early neonatal deaths accounted for 33 to 38 per cent of infant mortality in 1986-90 in Matlab. Perinatal mortality is expressed as a ratio of perinatal deaths per 1,000 total births (live births plus stillbirths).

In contrast with child mortality and post-neonatal mortality, which depend in large part on the environment, neonatal and perinatal mortality are mostly determined by biological factors, and particularly maternal factors. Many maternal factors, however, also depend on the social environment. In a sense, they are environmental factors affecting the foetus, and largely determine its size at birth, which, in turn, determines survival.

Since the start of the MCH-FP project in Matlab, neonatal mortality has received considerable attention, first because it was observed to be substantially high, and secondly because many researchers were **fascinated** by the study of the impact of a simple intervention: the immunization of mothers with tetanus toxoid to protect their babies from neonatal tetanus.

Only recently has attention focused on other neonatal pathologies, for example prematurity and dysmaturity (small size for gestational age), and on other potential interventions to reduce neonatal and perinatal mortality, such as maternity care. These more recent studies have been triggered by detailed investigations of

the causes of neonatal and perinatal deaths in the community, investigations which revealed the considerable impact on neonatal mortality of the complications associated with a small size at birth.

In this chapter classical studies of neonatal tetanus conducted in Matlab since 1975 are reviewed, as well as more recent studies on the epidemiology of neonatal and perinatal health. Then various interventions tried in Matlab to address neonatal and perinatal problems are described, among which maternal tetanus immunization, training of traditional birth attendants, and maternity care.

1. EPIDEMIOLOGY OF NEONATAL MORTALITY

1.1. Levels of Neonatal mortality

Neonatal tetanus has been reported to be a leading cause of neonatal death in many parts of rural Bangladesh. In Companigonj, Chowdhury, *et al.* (1980) reported that neonatal tetanus accounted for 28 per cent of all neonatal deaths over the three-year period from 1975 to 1977, while birth injuries and other complications of delivery accounted for 54 per cent.

In Teknaf, Islam, *et al.* (1982) found that neonatal tetanus was responsible for 31 per cent of all neonatal deaths in 1976-77, with a neonatal tetanus-specific death rate of 27 per 1,000 live-births.

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Neonatal and Perinatal Health

In Matlab, Chen, *et al.* (1980) estimated that neonatal tetanus was responsible for 26 per cent of all infant deaths between 1975 and 1977, with a neonatal tetanus-specific death rate of 37 per 1,000 live-births (the percentage distribution of neonatal deaths was not reported in this study).

Neonatal tetanus is also a major cause of death in other parts of the Indian subcontinent (Smucker, *et al.*, 1980; Suleiman, 1982). Simmons, *et al.* (1978) reported that between 1965 and 1969, neonatal tetanus was responsible for 53 per cent of all neonatal deaths in Uttar Pradesh, with a specific death rate of 54 per 1,000 live-births.

Stanfield & Galazka (1984), in their review of neonatal tetanus worldwide in the early 1980s, estimated the number of neonatal tetanus deaths to be nearly 400,000 per year in the South-East Asia region only.

1.2. Causes of neonatal mortality

It should be pointed out that the findings reported in the above studies were based on the diagnoses made by lay field workers, and it is likely that the category of "death due to neonatal tetanus" was over-estimated relative to other causes of neonatal death.

In Bangladesh, and perhaps also in neighbouring countries, all neonatal deaths accompanied by neurological symptoms, such as convulsions or stiffness, are commonly assigned to *alga* or *takuria,* regardless of the infant's age at the onset of symptoms.

Alga and *takuria* are local names encompassing any disease with spectacular or dramatic symptoms believed to be caused by spirits or evil winds, and may include true neonatal tetanus but also other severe conditions (see Chapter 5 for a discussion on the assignment of cause of death). Attempts to more accurately assess the role of neonatal tetanus in neonatal mortality, through more rigorous analysis of symptoms and timing (Zimicki, *et al.* 1985; Bhatia, 1989; Fauveau, *et al.*, 1990a and 1990b) have led to lower estimates than those reported above.

Table 1 (facing page) presents more recent assessments of rate and causes of neonatal mortality during four periods between 1978 and 1990. As can be seen, neonatal tetanus accounted for 2 per cent of neonatal deaths in the Matlab comparison area in 1982-83 (Bhatia, 1989), and 21 per cent of neonatal deaths in the same area in 1986-87, with a corresponding cause-specific rate of 11 per 1,000 live-births (Fauveau, *et al.*, 1990a).

A dramatic decline in neonatal tetanus mortality, however, was observed in 1989-90, with neonatal tetanus responsible for only 8 per cent of all neonatal deaths.

A striking finding of studies of mortality from neonatal tetanus in Matlab is the predominance of male over female deaths. During each year between 1986 and 1990, there have consistently been twice as many male than female deaths due to neonatal tetanus. This sex differential has also been reported in other parts of the Indian subcontinent and in other countries (Stanfield & Galazka, 1984). The reasons for this highly significant difference do not seem to lie in differences in case-reporting, but rather in different practices regarding the cutting and dressing of the umbilical cord at delivery.

TABLE 1

Neonatal mortality in Matlab 1978-1990, rates and causes.

Years of study Authors	1978-79# Rahman, *et al* (1982)		1982-83 Bhatia (1989)		1986-87 Fauveau, *et al.* (1990)		1989-90 Fauveau (unpublished)	
	Comp	MCH-FP	Comp	MCH-FP	Comp	MCH-FP	Comp	MCH-FP
Rate per 1,000 LB	74.1	71.2	67.1	56.8	53.9	44.9	44.3	41.4
No. of deaths	401	267	548	387	414	299	348	263
CAUSES OF DEATH (Per cent)								
Complications of a small size at birth	-	-	38	39	35	44	45	59
Birth trauma	-	-	4	9	11	14	11	8
Neonatal tetanus	-	-	20	13	21	7	8	1
Neonatal pneumonia	-	-	14	13	9	10	8	9
Diarrhoea	-	-	1	3	1	1	1	2
Other infections	-	-	3	4	9	11	6	3
Other disorders	-	-	12	11	2	2	5	6
Impossible.to specify	-	-	8	8	12	11	16	12

 # : September 1978 to December 1979 (16 months)

CONTINUED...
Neonatal and Perinatal Health

One possible explanation might be a tendency to put more material containing tetanus spores (cow-dung, clay) on the umbilical stump on male than female infants. Another possible explanation might be a tendency to perform more ritual scarifications, with a corresponding increase in application of dressings, in male than female infants. So far, however, there have been no in-depth investigations into gender differences in such practices in Matlab.

Other common causes of neonatal deaths are shown in Table 1: the leading cause reported after 1981 was a group of complications due to a small size at birth, including prematurity and small-for-date.

This cause accounted for 38 to 39 per cent of all neonatal deaths in 1982-83, and for greater proportions in subsequent years (up to 59 per cent in the MCH-FP area in 1989-90). Previous assessments of cause of death, however, had not taken into account the size at birth, because of the lack of information on size at birth or birth weight.

In 1982, Bhatia introduced questions to mothers or birth attendants about the size at birth of the infants who died. The systematization of this practice in subsequent years was perhaps responsible for the shift from many causes identified as "other neonatal disorders" in 1982-83 towards causes termed "complications of a small size at birth" in subsequent years.

CONTINUED...
Neonatal and Perinatal Health

The third most common cause of neonatal death reported in Matlab was neonatal pneumonia, which accounted for 8 to 14 per cent of all neonatal deaths.

The assessment of neonatal pneumonia as a cause of death, however, should be treated with caution: there are many difficulties in reporting specific criteria for the diagnosis of neonatal pneumonia, and many symptoms are also reported in other causes of neonatal death, such as birth asphyxia, certain complications of prematurity, and other neonatal infections, including neonatal tetanus.

Finally the very low proportion of neonatal deaths due to diarrhoea must be noted. This is probably a result of the almost universal practice of exclusive breast feeding during the first month in rural Bangladesh.

1.3. Trends in neonatal mortality

Data relating to the study of trends in neonatal mortality over time are available in a consistent format from 1974 to 1990 from the Matlab DSS. However, data on trends in neonatal tetanus-specific mortality are only meaningful if they come from cause of death assessment systems that have been consistent over the relevant period. This is the case from only 1982 onwards in Matlab, when the improved assessment of cause of death was implemented by Bhatia (1989).

Figure 1 (facing page) shows trends in neonatal mortality from 1974 to 1990 in MCH-FP and comparison areas. As pointed by Chowdhury, *et al.* (1985), one plausible explanation for the lower neonatal mortality in the MCH-FP area than in the comparison area between 1974 and 1976 can be the effect of the 1974 Cholera Vaccine Trial reported earlier (see Chapter 3).

It was planned to distribute tetanus toxoid, used as a placebo for this double-blind trial, to more women in the MCH-FP area than in the comparison area, and there was in fact a higher acceptance (and coverage) in the MCH-FP area than in the comparison area.

This effect, in addition to the positive effect of maternal immunization of mothers on mortality from neonatal tetanus, as reported by Black, *et al.* (1980) and Rahman, *et al.* (1982), may explain the observed difference in neonatal mortality between areas. But this effect could not be determined beyond 1977 because of the confounding influence of the Family Planning-Health Services Project (FPHSP) in which tetanus toxoid

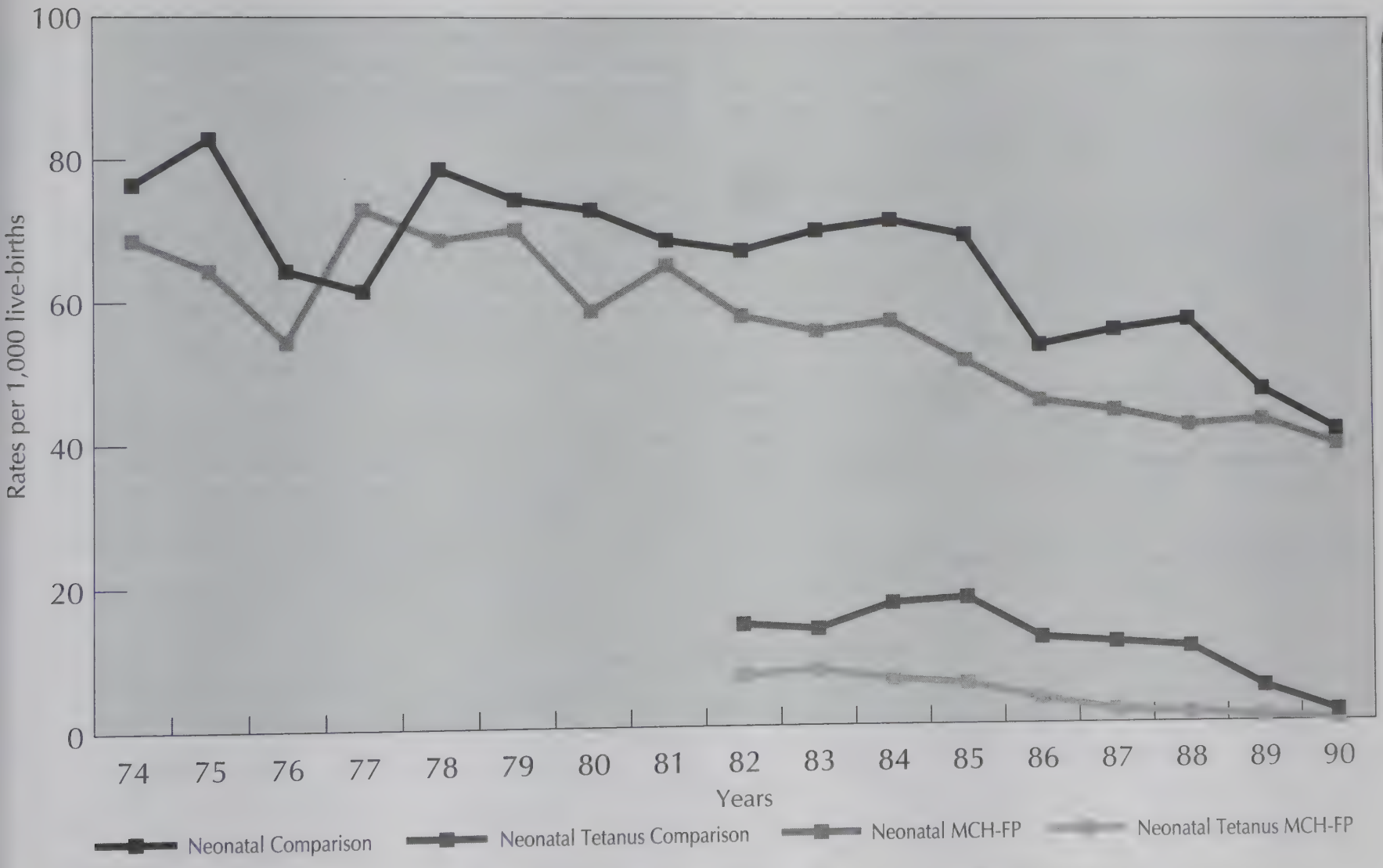

Fig 1 : Neonatal and Neonatal Tetanus Mortality
Matlab MCH-FP and Comparison Areas, 1974-90

CONTINUED...
Neonatal and Perinatal Health

immunization of pregnant women was initiated in June 1978 (Bhatia, *et al.*, 1980).

The combination of circumstances which led to neonatal mortality rates being higher in the MCH-FP area than in the comparison area in 1977 is not clear. Thereafter, from 1978 onwards, the neonatal mortality rate was consistently lower in the MCH-FP than in the comparison area, but it declined also consistently in both areas. A striking finding is the drop in both neonatal and tetanus mortality rates in the comparison area in 1986 and again in 1989-90. The improved coverage of tetanus toxoid immunization of mothers in the comparison area, operating in EPI mass-campaign modes, does not seem to be enough to explain these impressive drops.

The slopes of decline in neonatal mortality rates in both areas is not significantly different, despite the interventions implemented in the MCH-FP area, which suggests that tetanus toxoid immunization of women might be the major factor responsible for the decline in neonatal mortality.

This hypothesis is supported by the observation of trends in neonatal tetanus mortality in both areas from 1982 to 1990 (Figure 1). Although the same assessment methods were used in both areas during this period, there was only a marked decline in neonatal tetanus-related mortality in the comparison area from 1986 onwards, when the nationwide EPI campaign started, while the decline in the MCH-FP area during the same period was much more modest.

2. PERINATAL MORTALITY

The first study of perinatal mortality in Matlab was carried out by Fauveau, *et al.* (1990), who reported rates, causes, determinants and seasonal patterns during the period from 1979 to 1986. Overall, the perinatal mortality rate was 75 per 1,000 total births (live births and stillbirths), with stillbirths and early neonatal mortality rates each comprising 50% (Table 2, below).

The causes of perinatal deaths were assessed from a subsample of perinatal deaths, by combining information provided on birth and death forms and home-interviews of mothers and birth attendants. Of the identified causes, the most common was complication associated with a very small size at birth (prematurity and small-for-date), which were responsible for 25 per cent of still-births and 54 per cent of early neonatal deaths.

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Neonatal and Perinatal Health

TABLE 2

Perinatal mortality in Matlab, 1979-86

	Total births			Still births			Early neonatal deaths			Perinatal deaths		
	Male	Female	All	Male	Female	All	Male	Female	All	Male	Female	All
No.	30832	29218	60050	1223	990	2213	1215	1058	2273	2438	2048	4486
Rate	-	-	-	39.7	33.9	36.9	39.4	36.2	37.9	79.1	70.1	74.7

(per 1,000 total births)

The second most important cause was complication of prolonged or obstructed labour (birth trauma), responsible for 31 per cent of still-births and 26 per cent of early neonatal deaths. Other important causes of early neonatal deaths are summarized in Table 3 (below) and include neonatal tetanus between the 4th and 7th days of life.

Perinatal mortality follows an asymmetrical U-shaped relationship when maternal age increases, as well as when gravidity increases. This U-shaped relationship persists when maternal age increases for a given gravidity, as well as when gravidity increases for a given maternal age.

Among other determinants of still-birth and neonatal mortality, Mostafa, *et al.* (1991) found a past history of previous foetal wastage and a short pregnancy interval of less than 18 months to be the most significant.

No significant association was found between perinatal mortality and socio-economic determinants, such as maternal and paternal education and paternal occupation.

Between 1966 and 1969, Swenson and Harper (1979) examined the relationship between foetal mortality (early foetal death and still-birth), pregnancy order, maternal age and previous foetal deaths in Matlab.

TABLE 3

Causes of early neonatal death, Matlab 1986.

	days 1 to 3		days 4 to 7		First week of life	
Cause of death	**n**	**%**	**n**	**%**	**n**	**%**
Disorders due to very small size at birth	91	63%	24	36%	115	54%
Birth trauma/hypoxia	45	31%	10	15%	55	26%
Neonatal tetanus	0	0	16*	25%	16	8%
Acute respiratory infection	0	0	4	6%	4	2%
Other neonatal disorders	0	0	6	9%	6	3%
Malformation/accident	3	2%	2	3%	5	2%
Unable to specify	6	4%	3	5%	9	4%
All causes	**145**	**100%**	**65**	**100%**	**210**	**100%**

** 13 among males vs. 3 among females: Odds ratio=4.3, p=0.015*

CONTINUED...

Neonatal and Perinatal Health

Partly due to the progress of immunisation programmes, and partly to nutrition activities, infant mortality has been reduced in the recent years in the Project area.

Healthy infants grow up to be healthy children and, eventually, more productive citizens tomorrow

They reported a higher foetal mortality in primigravidas and in women with multiple pregnancies than in women with two or three pregnancies, but established a significantly higher risk in women who had already experienced two or more foetal deaths. They concluded that women who survive high pregnancy orders are more likely to be those without reproductive impairments.

3. GROWTH IN-UTERO AND OUTCOME OF PREGNANCY

3.1. Foetal growth

A programme of examination of pregnant women in the Matlab community began in early 1987, and covered two blocks of the MCH-FP area, with approximately 1,550 births each year. Pregnant women were advised by community health workers to call one of the two midwives for a home visit, or to visit the health centre at least once during pregnancy.

The examination comprised a general and an obstetrical check, including the measurement of uterine height between symphysis and fundus.

The data collected allowed for the study of foetal growth as well as a number of other issues related to pregnancy. This first attempt to collect data on foetal growth in a rural Bangladeshi community suffered from a selection problem: not all pregnant women were examined; not all examined women were examined at the same stage of pregnancy; and some women were examined more than once. The relatively high number of women examined, however, can provide a general indication on the progression of fundal height in pregnancy.

Figure 2 (overleaf) illustrates foetal growth through changes in fundal height among groups of women at different stages of pregnancy (twin pregnancies excluded). Altogether the progression is slow, and also limited in magnitude, with a maximum fundal height of 26 cm during the ninth month (eight completed months).

The one-centimetre drop after nine months may be explained by the fact that some of the women examined were already in labour. From a sample of 398 pregnant women, the baby was examined at birth and chest circumference was measured (see below), allowing for a classification of babies smaller than average and babies larger than average.

Fundal height was consistently smaller at each stage of pregnancy for the first group of babies than for the second group (V. Fauveau, unpublished). Some researchers have suggested using a graph of fundal height as an instrument to detect intra-uterine growth retardation (Belizan, *et al.*, 1978; Kennedy, 1990).

Given the lack of effective interventions for this condition, however, there does not seem to be much use of such a tool at present in rural Bangladesh. It may be a potentially useful tool in the future to identify mothers whose babies will need special care at birth.

3.2. Size at birth

The most common measure of size at birth — birth weight — is also one of the most difficult to obtain with accuracy in places such as rural Bangladesh. In addition, the relevance of the WHO-recommended cut-off point of 2,500 g for low birth weight is debatable in areas where the measurement of birth weight is not done owing to logistic or cultural constraints. Yet it is precisely in these areas that the incidence of small size at birth is highest and interventions to prevent the correlated early mortality are necessary.

In fact, there is no biological reason for neonatal survival being more dependent on weight, chest circumference, or any other indicator of body size at birth. Therefore, an indicator combining greater feasibility, higher cultural acceptance, and as good predictability as birth weight can be proposed as a valid alternative.

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Neonatal and Perinatal Health

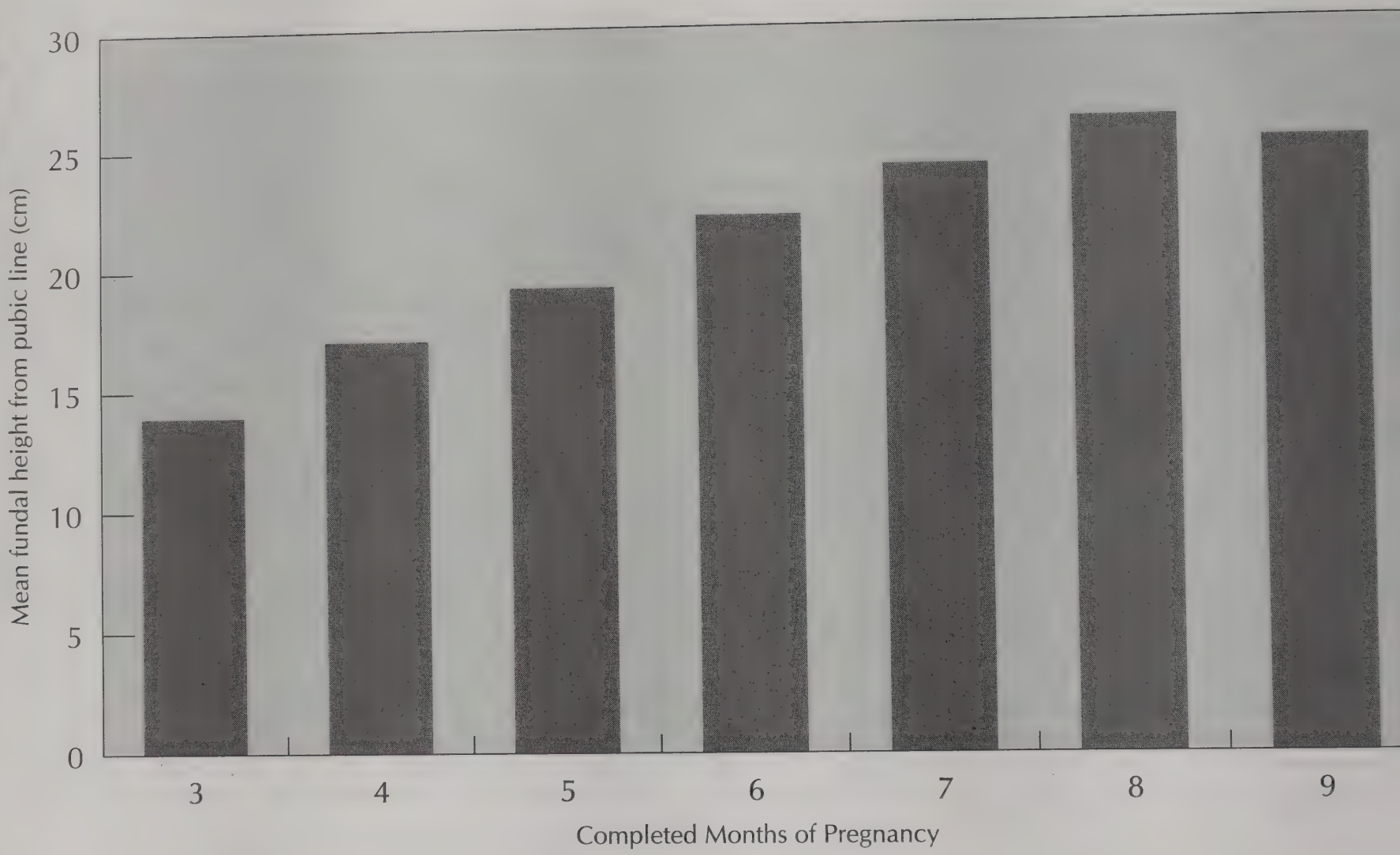

Fig 2 : Foetal growth in rural Bangladesh
MATLAB MATERNITY CARE PROJECT, 1987-89

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Neonatal and Perinatal Health

On the basis of the findings of research into alternative predictors of early mortality, chest circumference at birth (CCB) was selected as a valid alternative, and tested in Matlab by Fauveau, *et al.* (1992). The correlation of CCB with birth weight was first verified on a subsample of births in the Matlab Maternity Clinic. This correlation was found to be highly significant (r=0.92), and the regression formula indicated that the WHO cut-off point of 2500 g corresponded to a CCB of 300 mm.

From April 1987, midwives and community health workers from the Matlab Maternity Care Project visited 509 households where babies had just been delivered, examined neonates and measured their chest circumference with plastified insertion tapes. These tapes were the same as those used for screening malnourished children by measuring mid-upper-arm circumference in the MCH-FP project. The chest was measured on the nipple line, at exhalation, and recorded to the nearest even number in millimetres.

The mean CCB was 306 mm (SD 24, twins excluded), which corresponded to a birth weight of 2,620 g. The mean CCB of 25 neonates who died within 4 months of life was 274 mm (SD 34), which was *significantly lower* than the mean CCB of 307 mm (SD 22) of those who survived 4 months (p<0.001).

The risk of dying within 4 months of age with a CCB less than 306 mm relative to a CCB of 306 mm and more was found to be 7.8 (95% CI 2.9-21, Table 4, below).

The risk of dying within one month of age with a CCB less than 300 mm relative to a CCB of 300 or more was 43 (13-138).

The optimum combination of sensitivity and specificity was found for a CCB less than 300 mm predicting death within one month (Table 4, below). The relationship between CCB and the risk of early mortality is expressed in Figure 3, (overleaf).

Measurement of CCB was simple, quick, cheap, and easily accepted by the rural Bangladeshi community. It could be used to

TABLE 4

Incidence density ratio, sensitivity, specificity, and attributable risk associated with selected values of chest circumference at birth, Matlab, 1987-89.

	No of neonates	Prevalence in population (%)	No died	Incidence Density Ratio (95%CI)	Sensitivity (%)	Specificity (%)	Attributable Risk (%)
DIED WITHIN 4 MTHS OF AGE							
CCB<306 mm	247	48.5	22	7.8 (2.9-21)	88	54	77
CCB<300 mm	156	30.6	20	9.1 (4.1-20)	80	72	71
DIED WITHIN 1 MONTH OF AGE							
CCB<306 mm	247	48.5	17	19.3 (4.7-79)	94	53	89
CCB<300 mm	156	30.6	17	43.0 (13-138)	94	72	92

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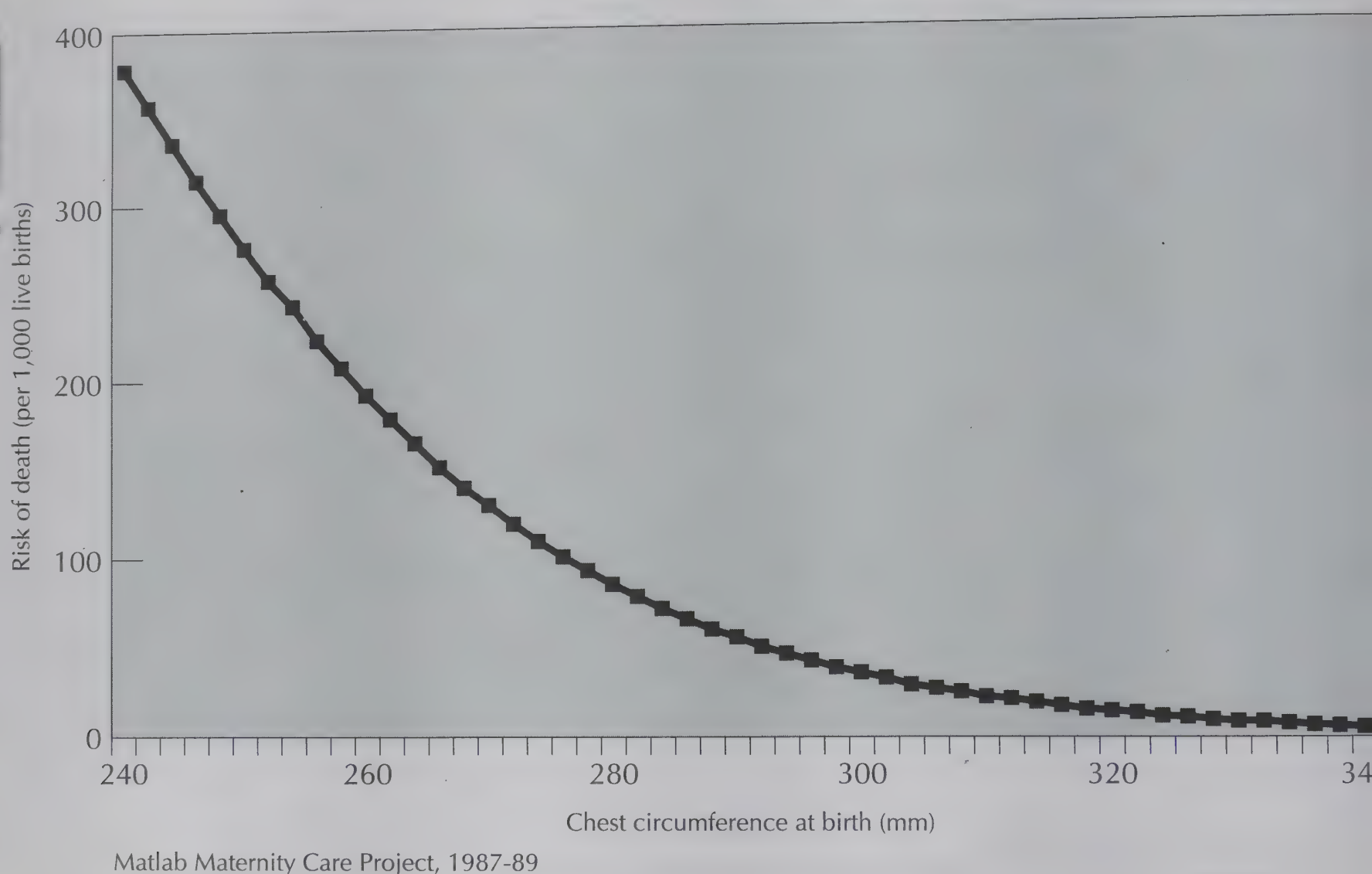

Matlab Maternity Care Project, 1987-89

Fig 3 : Risk of death within 4 months according to chest circumference at birth

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Neonatal and Perinatal Health

predict the risk of early mortality with reasonable confidence. It is less sensitive than birth weight to changes in the first days of life. It can be proposed as a valid alternative to birth weight or other measures of size at birth.

Like other measures, however, a low CCB does not discriminate between prematurity and intra-uterine growth retardation, which have different prevalences and case-fatality rates.

It has been shown elsewhere that in developing countries, intra-uterine growth retardation is generally more frequent and less severe than prematurity. In South Asia, up to 75% of low birth weight infants have been reported to be small for gestational age (WHO, 1980).

The data indicate that 31% of all neonates in this community had a CCB below 300 mm, corresponding to a low birth weight according to the WHO-recommended cut-off point. These figures must be compared with the only previous estimate of mean birth weight in rural Bangladesh: In a study carried out in 1977 on a sample of 122 neonates in a rural village adjacent to our study area, the mean birth weight was 2,500 g (Khan, 1979).

A recent survey of the Matlab community health workers, who perform regular home-visits in villages, indicated that half of the community mothers would not allow their newborn's weight to be measured at birth, for fear that the actual process of weighing would in fact cause weight loss. These women would be precisely those whose newborns would be most exposed to low birth weight and early mortality. Education campaigns might overcome these parental attitudes, but this will take time. Similar attitudes towards measuring CCB have not been reported in the study area.

The measurement of CCB can be performed easily by community health workers, and eventually by traditional birth attendants, using simplified knotted strings Figure 4 (overleaf).

Chest circumference at birth, however, is not recommended as an indicator to evaluate changes over time, unless to assess long time trends, but in this case the consistency of distribution of births must be ensured. Its best use is as a tool for targeting interventions or special attention. In this case, the choice of a cut-off point will depend on the type of intervention available.

The number of effective field interventions to prevent the death of neonates with a small size at birth, however, is limited. Warming, early colostrum feeding, protection against infection, supportive maternal care, and early referral to well-equipped health centres are among the few possible interventions.

Provision of maternity care centres in rural areas, staffed by community midwives and equipped with simple warming devices, suction devices, antibiotics, and oxygen, may also prove effective.

3.3. Multiple pregnancies (Twins)

Although approximately one of 80 pregnancies is a twin pregnancy, the incidence of this common phenomenon varies considerably with race and other factors and its determinants are not clear. The incidence of monozygotic twinning (the result of a single ovulation) being almost constant throughout the world, variations in twinning rates are attributed to the incidence of dizygotic twinning (the result of double ovulation, Shipley, *et al.* 1967). Razzaque, *et al.* (1990) have reviewed the twinning rates in Matlab over a period of 16 years from 1968 to 1983.

CONTINUED...

They reported rates fluctuating between 7.9 and 11.0 per 1,000 pregnancies, with much greater rates in older and higher parity mothers than in younger and lower parity mothers.

The strong correlation between maternal age and twinning rate is due to dizygotic twins only. Higher twinning rates were also reported in the MCH-FP than in the comparison area from the start of the Family Planning-Health Services Project in 1978, and

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it was hypothesized that hormonal contraception might be one influencing factor. In another study in Matlab, Chowdhury, *et al.* (1991) compared the survival of discordant twins with that of a random sample of singletons from the same population. Neonatal and infant mortality rates of twins were found to be respectively five and four times those of singletons. Higher female than male mortality was reported to occur earlier and in greater magnitude among discordant twins than among singletons.

3.4. Birth practices and early feeding practices

Feeding during pregnancy, birth practices, attendance at delivery, methods of cutting the umbilical cord, postpartum feeding and

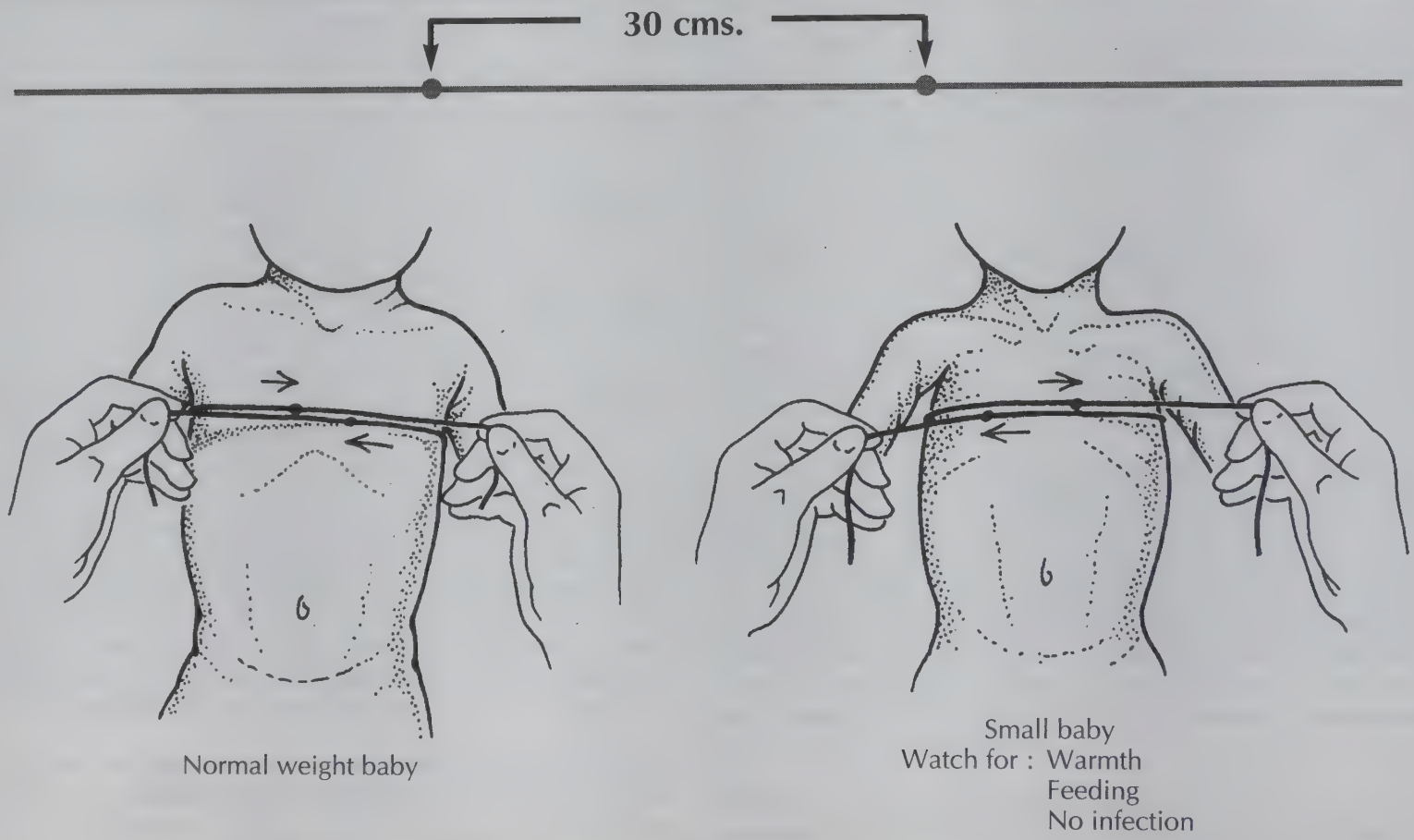

Fig 4 : Knots 30 cms. apart in a piece of non-stretch string

CONTINUED...
Neonatal and Perinatal Health

restrictions on feeding, have all been observed and reported by social scientists (Aziz 1985; Maloney, *et al.* 1981; Bhatia, 1981, Islam, *et al.* 1984, 1986) and epidemiologists (Mostafa, 1989).

3.5. Outcome of pregnancy

The outcome of pregnancy is routinely registered in the Matlab demographic surveillance system, but previous pregnancies and date of last menstrual periods are not. As a result, early pregnancy terminations are often missed, and the exact duration of pregnancy is not known exactly.

There are four types of pregnancy outcomes: live births, stillbirths, spontaneous miscarriages, and induced miscarriages.

In their review of pregnancy terminations between 1966 and 1969, Swenson and Harper (1979) reported that 10 per cent of all pregnancy terminations were registered as foetal deaths, and fewer than 5 percent as stillbirths.

Pebley, *et al.* (1985) studied intra-uterine mortality (or foetal loss) among Matlab women between October 1975 and April 1978. They found unexpectedly high rates, particularly during the third trimester of pregnancy, and suggested that these high rates were due to environmental conditions, that is maternal factors.

The most significant of these factors were maternal pre-conception weight and weight gain during pregnancy, both found to be remarkably low on the average. Maternal age, parity and maternal height were also significantly related to foetal mortality. The strong seasonal variations observed in foetal loss were explained by variations in women's workloads, food availability, and diseases.

A review of DSS data during 1983-1988 indicates the following proportions of pregnancy outcomes (Table 5, below):

However, it must be pointed out that it is practically impossible to validate these proportions on a large scale, given the uncertainties about reporting early miscarriages, induced miscarriages, and even stillbirths.

3.6. Seasonality

Seasonality of births in Matlab was first reported by Becker, *et al.* in 1981, and later confirmed in other studies (Becker, *et al.*, 1986).

TABLE 5

Pregnancy outcomes in Matlab, 1983-88.

	MCH-FP area	Comparison area	Both areas
Total pregnancies (N):	21,501	26,518	48,019
Live births:	89.8%	87.5%	88.5%
Stillbirths:	3.3%	3.2%	3.2%
Miscarriages:	7.0%	9.2%	8.2%

CONTINUED...

A remarkably consistent peak of births is observed during the end of the rainy season (October and November) and the beginning of the cold season (December).

Not surprisingly, these months also experience the highest absolute numbers of neonatal and perinatal deaths. The highest neonatal and perinatal mortality rates, however, are found a few months earlier, mostly towards the end of the rainy season.

These findings have implications for focusing programmatic efforts in MCH and FP: the emphasis should be on the promotion of contraceptive use during the winter season, corresponding to the peak of conceptions, but also on the provision of maternity care services throughout the rainy season and up to the beginning of the dry season.

3.7. Sex differentials

Higher rates of male over female perinatal and neonatal mortality have been consistently reported in Matlab. In 1982-83, Bhatia (1989) assessed this excess of male over female neonatal mortality at 6 per cent only, with a greater differential in the MCH-FP area than in the comparison area.

In 1986-87, Fauveau (unpublished) found a much higher figure of 18 per cent, again with a greater differential in the MCH-FP area (26 per cent) than in the comparison area (14 per cent). During the same period, there was an excess of male over female perinatal mortality of 13 per cent.

CONTINUED...
Neonatal and Perinatal Health

Although none of these differences reach statistical significance, the presence of this consistent differential, and its causes, would be interesting to investigate, since this is probably the only age group in this community to experience such an excess of male over female mortality. One explanation commonly put forward is the biological superiority of the female sex, as posited in other parts of the world. But the significant and consistent differences in MCH-FP and comparison areas raise the hypothesis of potential behavioural factors.

It is possible, as already proposed in the case of neonatal tetanus, that more traditional practices are carried out in the case of male neonates, with a concomitant detrimental effect on survival.

4. INTERVENTIONS

4.1. Effect of maternal tetanus immunisation

Although tetanus toxoid (TT) immunization was offered to a substantial number of women as a placebo in the large double-blind cholera vaccine trial of 1974 (Curlin, *et al.*, 1975; Black, *et al.*, 1980), TT immunization of pregnant women to protect newborn infants against neonatal tetanus was among the first health interventions to be implemented systematically within the Family Planning-Health Services Project (FPHSP).

From June 1978, TT immunization was offered to all pregnant women in all four blocks of the MCH-FP area.

During a second stage, from 1982 in the two Blocks A & C, and from 1986 in the two Blocks B and D (Page 52), TT immunization was offered to all married women irrespective of the status of their pregnancy .

Coverage rates were initially low, not exceeding 30 per cent of pregnant women during the first 18 months (Rahman, *et al.*, 1982b). These rates increased after 1982 in Blocks A and C, and after 1986 in Blocks B and D, when immunization was being offered to all married women, and reached 85-90 per cent of all pregnant women.

Information on TT immunization (dates, doses) and coverage rates in the MCH-FP area are available from the mother section of the CHW's service record books. Coverage rates in the comparison area are based on occasional surveys, the latest of which was carried out in 1990.

TT immunization is not expected to have an impact on mortality beyond the neonatal period, nor on causes of death other than neonatal tetanus. In fact, mortality between the ages of 4 and 14 days has often been used as a proxy for neonatal tetanus mortality.

Prospective studies on the effectiveness of TT immunization have been carried out by Rahman, *et al.* (1982a) and Black, *et al.* (1980). These evaluations took into consideration the low immunization coverage among pregnant and non-pregnant women due to socio-cultural constraints (Rahman, *et al.*, 1982b; Chen, 1986).

No retrospective study has been carried out restricting the analysis of impact of TT immunization to deaths from neonatal tetanus alone. A potential confounder in the analysis of trends may come from the 1974 Cholera Vaccine Trial, in which tetanus toxoid was used as a placebo (Black, *et al.*, 1980). Recent analyses have shown one and two doses of TT to have prolonged protective effects, up to 15 years after immunization (Shahidullah, *et al.*, unpublished, Koenig, *et al.*, 1991).

In the same analyses, the differences in neonatal mortality (as well as 4-14 days mortality) between cohorts of neonates born to women immunized with one dose or two doses of TT were not found to be significant. These findings are free of selection bias, since TT injections were provided as part of a double-blind trial randomised on individuals.

4. 2. Other differences between MCH-FP and Comparison areas

Are most of the differences in neonatal mortality observed between MCH-FP and comparison areas due to the impact of TT immunization of mothers in the MCH-FP area?

Is there an effect on neonatal tetanus of other interventions, such as distribution of safe delivery kits to pregnant women, or training of traditional birth attendants (TBAs)?

Is there an effect on neonatal deaths due to causes other than tetanus of other services offered to women, such as distribution of safe delivery kits, TBA training, iron-folate supplementation during pregnancy, or nutritional advice during pregnancy?

It is difficult to answer these questions, partly because the interventions in question were not implemented in a controlled fashion with a potential scientific evaluation in view, and partly because the use patterns of these services have not been recorded (while the distribution of drugs or kits has been properly recorded by community health workers).

In addition, it was frequently observed that women who accepted one of these services tend to accept all of them, while other women did not accept any, and this may be a source of bias in the evaluation of the individual effect of these services.

4.3. Effect of the maternity care programme on neonatal mortality

A Maternity Care programme was implemented in 1987 in the two Blocks C and D of the MCH-FP area, with the principal objective of reducing maternal mortality. (Details of this programme are found in Chapter 7.)

Besides its positive effect on obstetric mortality reported by Fauveau, *et al.* (1991), the effect of this programme on neonatal and perinatal mortality was also examined.

An estimate of this effect was obtained by comparing neonatal mortality ratios (per 1,000 live-births) between the programme area (Blocks C and D) and a comparable control area (Blocks A and B), during the periods before (1984-86) and after (1987-89) the start of the maternity care programme.

During the six years covered by this study, a total of 915 neonatal deaths were reported in the study area, 492 in the control area and

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Neonatal and Perinatal Health

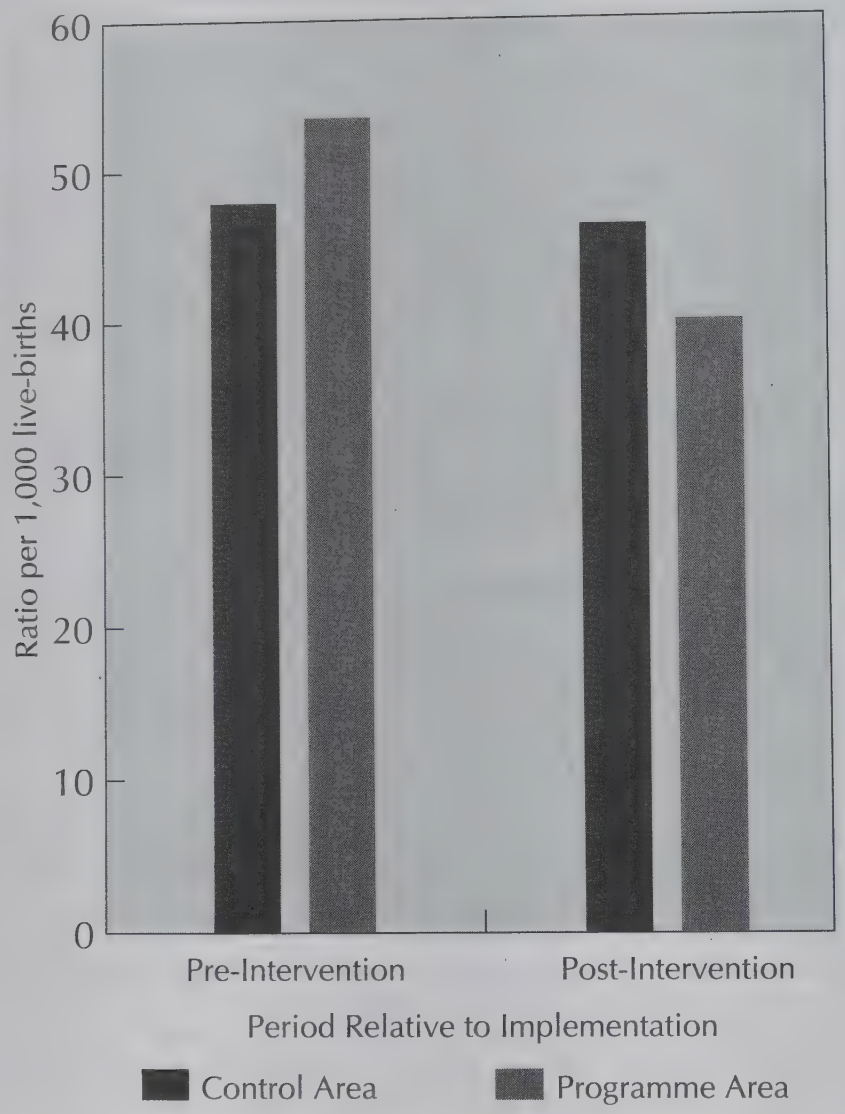

Fig 5 : Neonatal mortality ratios
Matlab Maternity Care Programme, 1984-89

423 in the programme area. During the baseline period, the neonatal mortality ratio per 1,000 live-births in the programme area was slightly greater than that in the control area (53.9 vs. 48.1 per 1,000 live-births, Figure 5 (left).

During the three-year period after the start of the maternity care programme, however, the ratio in the programme area was slightly lower than that in the control area (40.3 vs. 46.7 per 1,000 live-births).

These differences in change were statistically significant: the risk of neonatal death in the intervention area relative to the control area was significantly lower during the years after initiation of the programme than during the preceding years.

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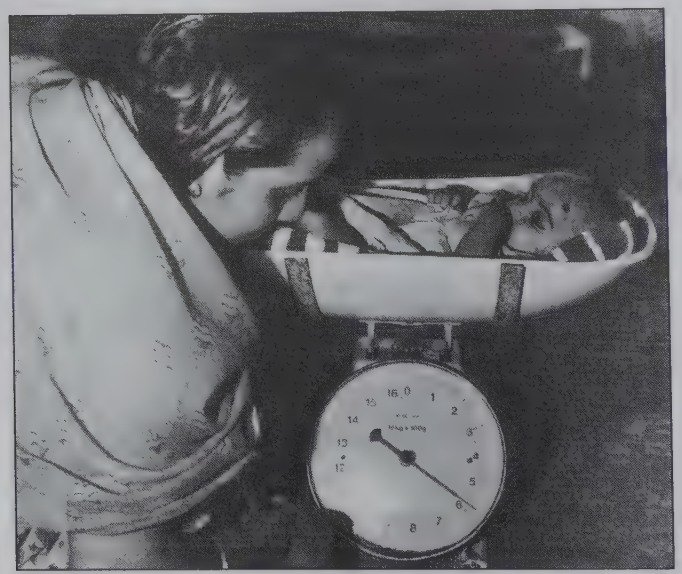

Monitoring the weight of infants is an important aspect of infant care.

CONTINUED...
Neonatal and Perinatal Health

CHAPTER 8

Neonatal and Perinatal Health in Matlab

Vincent Fauveau

Lessons learned...

Of all deaths during infancy (the first year of life), deaths during the first week are responsible for more than one third, and deaths during the first month are responsible for more than one half. These high proportions account for the difficulties in reducing infant mortality in areas with a high mortality, such as rural Bangladesh.

With the exception of maternal tetanus immunization, no other simple and effective intervention to reduce neonatal mortality has been demonstrated in Matlab

Recent detailed investigations of causes of neonatal deaths reveal that the importance of neonatal tetanus in neonatal mortality has been over-estimated in the past, rather than under-estimated as frequently stated.

The predominance of male over female mortality from neonatal tetanus has been clearly evidenced in Matlab, but the causes of this differential are still unclear.

In areas like rural Bangladesh where birth weight is extremely difficult to measure in the community, it makes sense to use alternative indicators of size at birth, such as a verbal assessment of size at birth or the measure of chest circumference within a few days of birth.

Still-births and early neonatal deaths are each responsible for about half of perinatal mortality, and both are predominantly due to complications associated with a small size at birth (prematurity and intra-uterine growth retardation).

The measurement of chest circumference at birth is as valid an indicator of the risk of early neonatal mortality as the measurement of birth weight. In addition, it is clearly easier to perform and more feasible to implement in the community.

The duration of protective immunity conferred by tetanus toxoid injections may be much longer than classically reported, and the number of injections necessary to produce life-long immunity may be much smaller (one or two may suffice)

A community-based maternity care programme aiming at reducing obstetric mortality has also a potential to reduce neonatal mortality.

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CHAPTER 9

Diarrhoeal Diseases : The Matlab Experience

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Robert E. Black
Amal K. Mitra
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K. Zaman
Vincent Fauveau
R. Bradley Sack

The International Centre for Diarrhoeal Disease Research, Bangladesh (ICDDR,B), formerly the Cholera Research Laboratory (CRL), has conducted diarrhoea-related activities in Matlab, a rural, riverine subdistrict of Bangladesh, since 1963. The field area was originally developed for evaluation of cholera vaccines. Accordingly, a series of trials have been done to assess the safety, immunogenicity, and efficacy of parenteral and oral cholera vaccines.

To support the field evaluation of cholera vaccines, a demographic surveillance system (DSS) was established in 1966. Over the years, the system has been refined (Ruzicka, *et al.*, 1978) and it is now operational in a population of about 200,000. Since the inception of work in the Matlab area, a Diarrhoea Treatment Centre (DTC) has been in operation to treat diarrhoea in patients from the locality. These resources provided the opportunity to conduct numerous clinical and epidemiological studies on diarrhoeal diseases, which have provided important insights into the epidemiology, aetiology, and therapy of all types of diarrhoea.

During the last fifteen years, the focus of service provision and research has been appropriately expanded to other areas, such as family planning, immunization and nutrition. In late 1977, a comprehensive Family Planning-Health Services Project (FPHSP) was initiated in half of the DSS villages. The remaining area that continued to receive health services from the Government of Bangladesh served as a comparison area (Bhatia, *et al.*, 1980; Phillips, *et al.*, 1984).

In addition to the DTC at Matlab, three Community-Operated Diarrhoea Treatment Centres (COTCs) were established — one in 1978 and the other two in 1982 (Baqui, *et al.*, 1984). Home treatment with ORT began at Matlab in 1978 (Chen, 1980a). Research activities during recent years have also provided equally important insights into the areas of population, nutrition, immunization, acute respiratory infection, and maternal health.

These studies and the lessons learned are covered in other chapters of this monograph. The purpose of this chapter is to summarize studies on diarrhoeal diseases in Matlab and to highlight the lessons learned. Only

Part II

the more recent diarrhoeal studies carried out at Matlab since 1974 have been reviewed, because earlier cholera studies have already been summarized in another book (Rahman, 1981).

This paper has been divided into the following sections: 1) Vaccine studies, 2) Clinic-based studies, 3) Community-based epidemiological studies, and 4) Intervention studies, including field trials of oral rehydration therapy. Whenever possible, data on watery diarrhoea, dysentery, and persistent diarrhoea have been presented separately.

1. VACCINE STUDIES

Over the years, a number of large cholera vaccine field trials have been conducted at Matlab. The detailed methodologies and the findings of these trials have been summarized in Chapter 3. This paper provides only a brief mention of the two most recent trials.

One of the largest field trials was carried out in 1974. This trial tested the Wyeth-gluteraldehyde-treated prototype cholera toxoid vaccine in 92,838 participants. Volunteers received on a double-blind basis either cholera toxoid or diphtheria-tetanus toxoid.

Analysis of the efficacy data showed that for Inaba cholera the overall protection in one year was 26 per cent, but almost all the protection was restricted to the 5-14-year-old group during the first 90 days.

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Diarrhoeal Diseases : The Matlab Experience

For Ogawa cholera, there was no significant protection in any age group (Curlin, *et al.*, 1978). In this trial the vaccine used as control proved to be more successful by providing protection against neonatal tetanus, thereby reducing mortality in children born to diphtheria-tetanus toxoid immunized women by 20 per 1,000 live-births (Black, *et al.*, 1980a).

More recently in 1985, a randomized double-blind field trial of two oral cholera vaccines — one a combination of killed whole *Vibrio cholerae* and the B-subunit of cholera toxin (WC/B), the other the killed vibrios alone (WC) — was carried out among 63,498 children and women.

Both vaccines provided 57 per cent protection for up to two years and 50-52 per cent protection for three years, but a lower rate of protection was observed in children aged less than 5 years (Clemens, *et al.*, 1986; 1988a; 1988b, 1990).

The WC/B also provided modest short-term cross-protection against diarrhoea due to *Escherichia coli* producing the heat-labile toxin (LT-ETEC) (Clemens, *et al.*, 1988c), but did not provide any protection against other members of the ***Vibrionaceae*** family (Clemens, *et al.*, 1989).

2. CLINIC-BASED STUDIES

Since 1963, the catchment area of the DTC has expanded considerably. At present the centre treats about 10,000 patients annually, only about a third of them residing in the DSS area. Forty per cent of the patients treated are children aged less than five years. About three-quarters of the patients come to the treatment centre with watery diarrhoea and about 20 per cent come with clinical dysentery (Baqui, *et al.*, 1991).

Since its inception, the DTC has maintained microbiological surveillance of all admitted DSS-registered patients for classic enteric bacterial pathogens, such as *V. cholerae, Shigella* spp. and *Salmonella* spp.

The clinic-based surveillance has been useful to describe the frequency, the severity and the seasonality of diarrhoea associated with these important organisms (Nalin, 1972; Glass, *et al.*, 1982; Zaman, *et al.*, 1987; Zaman, *et al.*, 1991). The surveillance also helped monitor the antibiotic sensitivity of enteric pathogens, identified outbreaks, including those due to multiple antibiotic-

resistant *V. cholerae* and *Shigella* **dysenteriae** type 1, and helped determine antimicrobial treatment strategies (Glass, *et al.*, 1980; Zaman, *et al.*, 1983).

The information on cholera provided by this surveillance from the DTC has been used to describe the epidemiology of cholera. From 1966 to 1973 the rate of hospitalisation ranged between 0.8 and 1.8 per 1,000 persons per year and nearly all of the *V. cholerae* were of the classical biotype.

The El Tor biotype was first identified in the Matlab area in 1969 and has predominated since 1973 while the classical biotype disappeared.

The rate of hospitalization appeared to increase in the El Tor period, ranging from 1.0 to 5.1 per 1,000 each year from 1974 to 1980.

However, classical cholera re-emerged in late 1982, becoming the predominant biotype that year (Samadi, *et al.* 1983; Khan, *et al.* 1984). *The two biotypes have co-existed in Matlab since that time.* The surveillance data indicate that the highest rates of cholera admitted to the DTC are found in children aged 2 to 9 years. Mapping of the cholera cases in the DSS villages found that each year primary cases begin almost simultaneously at distant points.

Further studies also indicate that the yearly cholera seasons begin with the emergence of strains of different phage types in many different locations, a finding more consistent with an environmental reservoir of *V. cholerae* than with a spread from a point source (Glass, *et al.*, 1982).

Beginning in 1979 multiple-drug resistant *V. cholerae* appeared in the Matlab area (Glass, *et al.*, 1983a). The resistance was mediated by a group C-plasmid and the data suggest that this outbreak originated from a point source and then spread throughout the area.

This strain subsequently disappeared from the area without major changes in antibiotic use, which included widespread use of tetracycline.

The DTC itself has also been implicated in the transmission of cholera in the Matlab area. Contamination of the water from a canal adjacent to the DTC may have led to the infection of persons using the canal water before an adequate treatment of hospital sewage was instituted (Levine, *et al.*, 1976).

In addition, as has been documented in other settings, nosocomial cholera can occur in patients admitted for other reasons due to appropriate hygienic precautions not taken (Ryder, *et al.*, 1986).

Comprehensive studies of enteric pathogens associated with diarrhoea were done twice at the Matlab DTC — once between 1977 and 1979 (Black, *et al.*, 1980b), and again between 1983 and 1984 (Baqui, *et al.*, 1991) (Table 1, overleaf).

In the 1977-79 study enterotoxigenic *Escherichia coli* (ETEC) was the most frequently identified pathogen for patients of all ages, being found in 23 to 28 per cent of children aged less than two years and in an even higher proportion of older children and adults.

Rotavirus was isolated from 46 per cent of patients aged less than two years. A bacterial or viral pathogen was identified for 70 per cent of these young children and 56 per cent of all patients with diarrhoea.

In comparison to the 1977-79 study, *V. cholerae* O1 and *Shigella* spp. isolation rates were much higher in the 1983-84 study (39 per cent in 1983-84 vs 12-14 per cent in 1977-79 and 11 per cent vs 5-6 per cent, respectively) (Table 1, overleaf).

The higher isolation rate of *V. cholerae* O1 may have been a reflection of year to year variations of the magnitude of the cholera outbreaks (Glass, *et al.*, 1982).

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The higher isolation rate for *Shigella* spp. has two possible explanations: a) until recently, the Matlab DTC was identified by the community as a centre for treatment of cholera and other watery diarrhoeas (Chen, 1978); an altered perception in the community might have changed the DTC case-mix bringing more patients with dysentery to the treatment centre and b) an outbreak of *S. dysenteriae* type 1 was occurring in 1983-84 in Matlab (Baqui, *et al.*, 1988).

In the 1983-84 study, 14 per cent of the patients yielded ETEC and 11 per cent yielded *Campylobacter* jejuni (not sought in the earlier study). A recognized enteric pathogen was detected in 69 per cent of the patients screened, 15 per cent of whom had a mixed infection.

DTC visits for diarrhoea associated with specific enteropathogens are very seasonal, although the number of cases of all diarrhoea

TABLE 1

Pathogens associated with diarrhoea at the Matlab Diarrhoea Treatment Centre, 1977-84 (percentages)

	Period		
Pathogen	**Feb 77-Jan 78***	**Feb 78-Jan 79***	**May 83-Apr 84****
Vibrio cholerae 01	12	14	39
Non group 01 Vibrio	7	7	3
Shigellae	5	6	11
ETEC	26	32	14
C. jejuni	....	....	11
Salmonella	<1	<1	1
Vibrio Parahaemolyticus	<1	<1	....
Group F Vibrio-like organism	3	<1	....
No pathogen isolated			
Rotavirus	....	24	....
Entamoeba histolytica	4	....	2
Giardia lamblia	2	....	2

** Black, et al., 1980b*
*** Baqui, et al., 1991*

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does not vary as much through the year. ETEC cases were noted to be highest in the hot months of March to September during the two-year period of 1977-79 (Black, *et al.*, 1980b).

In the same study rotavirus cases were also seasonal, they occurred throughout the year but predominated in the cool season (November-February), when cases associated with bacterial enteropathogens were at a low level.

Cholera cases occurred primarily between August and November with a peak in September. This study also documented the presence of intestinal helminthic infection in children (Hossain, *et al.*, 1981). While only 4 per cent of infants aged less than one year seen at the DTC had helminthic infection, the rate increased to 78 per cent in four-year olds. The most common infection was Ascaris, followed by hookworm and Trichuris.

Some of the early clinical trials of ORT were carried out at the Matlab DTC and these trials contributed significantly to the development of ORT (Nalin, *et al.*, 1969; Nalin, *et al.*, 1970; Cash, *et al.*, 1970a; Cash *et al.*, 1970b).

Initial studies concentrated on the use of oral glucose-electrolyte solution for the maintenance of fluid balance in adult cholera patients, and demonstrated the success of oral rehydration therapy (ORT) in reducing requirements for intravenous (IV) fluids in a field clinic with limited facilities.

These studies and the subsequent application of ORT to all cases of diarrhoea in adults and children in the DTC contributed greatly to the evidence for the effectiveness and appropriateness of this diarrhoea case-management approach.

Subsequent clinical trials were done to either explore further simplification of ORT or to demonstrate its effectiveness in specific types of diarrhoea, especially rotavirus, the predominant cause of dehydrating diarrhoea in young children in Matlab and globally.

A study by Taylor, *et al.*, (1980) found that children with rotavirus diarrhoea could be successfully treated with glucose-electrolyte solution and that vomiting did not preclude use of ORT.

A subsequent study compared glucose with sucrose as the sugar in the oral rehydration solution for treatment of rotavirus diarrhoea in children. The oral fluid failure rate was only slightly higher for the sucrose-containing solution (with somewhat more failures due to vomiting), indicating that sucrose-electrolyte solutions could be substituted for standard glucose-containing solutions if necessary (Black, *et al.*, 1981c).

Additionally, a study in the DTC demonstrated that the glucose-electrolyte solution could be used for rehydration and maintenance in diarrhoea treatment of breast feeding children without the addition of plain water (Roy, *et al.*, 1984).

The 1983-84 study revealed that although 91 per cent of the DTC patients had previously used ORT, 54 per cent of the patients came to the DTC with no or mild dehydration and more than half of them did not use ORT before coming.

To estimate the prevalence of electrolyte anomalies in children with diarrhoea and to document their relationship with dehydration, duration of diarrhoea, and nutritional state, 307 children aged less than five years were studied in 1982.

The results showed that hypokalemia and acidosis were common metabolic abnormalities in children with diarrhoea in rural Bangladesh (Zaman, *et al.*, 1984). The prevalence of hypokalemia was significantly higher in malnourished children (Zaman, *et al.*, 1985).

In 1975, Oberle, *et al.* (1980) reviewed the Matlab DTC to estimate the mortality averted by the DTC and its cost.

It was estimated that the DTC reduced the total mortality of the

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TABLE 2

Summary of longitudinal studies on diarrhoeal diseases carried out at Matlab, Bangladesh, 1981-92

Author and year	Period of study studied	Number of persons	Age studied	Frequency of surveillance.	Definition of diarrhoea used	Diarrhoea free days required for a new episode	Annual rate of diarrhoea per child <5 yrs	Peak rate	Age at peak rate
Black, *et al.* 1981a	1977-78	1245	0-60+yrs	Daily	≥4 liquid stools	3	2.8	4.3	9-11 mths
Chen, *et al.* 1981	1978-79	207	0-4 yrs	Weekly	≥3 abnormal stools	2	4.1	-	-
Black, *et al.* 1982a	1978-79	197	2-60 mths	Every other day	At least 1 day with ≥4 loose stools*	3	4.7	7	6-11 mths
Bairagi, *et al.* 1987	May-Dec 1976	1455	1-4 yrs	Weekly	≥3 watery stools or blood or mucus in stool	2	1.3	1.6	1 yr
Baqui, *et al.* 1992a	1988-89	705	0-4 yrs	Every 4th day	≥3 loose, liquid or watery stools or loose stool with blood	3	4.6	6.2	6-11 mths

*: *PLUS all subsequent days with ≥ 3 loose stools.*

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Matlab DSS area by 7 per cent to 15 per cent, at a cost of US$ 0.14 per capita. As indicated earlier, three COTCs were opened at Matlab between 1978 and 1982 to reduce costs and to increase access to diarrhoeal treatment.

These centres are run by trained volunteers under the supervision of local community management committees. To assess the role and importance of COTCs, the performance of two of these COTCs were reviewed after the 1982 cholera epidemic.

It was estimated that these two centres averted at least 820 deaths in this epidemic (Baqui, *et al.*, 1984). Later, a cost-effectiveness study compared the relative cost of Matlab DTC and the COTCs.

Comparing long run average cost, it took US$ 3.36 to treat a patient at the COTCs, compared with US$ 15.65 at the Matlab DTC (Horton, *et al.*, 1982). However, these costs are not directly comparable because of differing case-mix of Matlab DTC and COTCs; Matlab DTC serves as the referral centre for COTCs. It was concluded that COTC was a rational approach, which was simple, inexpensive and applicable under the adverse conditions and shortages of the developing world (Baqui, *et al.*, 1984).

3. COMMUNITY-BASED EPIDEMIOLOGICAL STUDIES

3. 1. Diarrhoea Morbidity Studies

A true assessment of the magnitude of the problem of diarrhoea is only possible from community-based studies with prospective surveillance. Five such studies have been carried out in the Matlab field area. The incidence rates observed and the methodology used in each of these studies have been summarized in Table 2 (facing page). Despite differences in the frequency of surveillance and definitions used, the overall and age-specific incidence rates observed in the studies by Black, *et al.* (1981a and 1982a, 1982c), Chen, *et al.* (1981) and Baqui, *et al.* (1992a) were similar.

Annual incidence in children aged less than five years ranged from 2.8 to 4.7. The age group with peak rates was 6 to 11 months old. However, the rates reported by Bairagi, *et al.* (1987) were much lower. Bairagi and co-workers used a more restrictive definition of diarrhoea as three or more daily bowel movements consisting of watery stools, or the presence blood or mucous in the stool.

Furthermore, their findings were based on only eight months of observation. This more restrictive definition and the short period of follow-up might be at least partially responsible for the low rates that they observed. Only one study documented diarrhoeal incidence rates in older children and adults (Black, *et al.*, 1981a).

Children aged 5-9 years had an incidence of one episode per year, while the population 10 years old and over had an annual incidence of only 0.14 episodes per person.

The rate of hospitalisation for diarrhoea from this population also varied by age; 3 per cent of children aged less than five years were hospitalised for diarrhoea in the year of surveillance, 1 per cent of older children, and 0.5 per cent of persons at least 10 years old.

The studies by Black, *et al.* (1982a, 1982c) and Baqui, *et al.* (1992a) also measured the incidence of persistent diarrhoea. The overall incidence of persistent diarrhoea observed by Black, *et al.* (38 per 100 child year) and by Baqui, *et al.* (34 per 100 child year) were remarkably similar. However, Black, *et al.* observed the peak rate (47 per 100 child year) in children between 36 and 60 months of age. In contrast, in the study by Baqui, *et al.* the peak rate was observed in infancy (75 per 100 child year).

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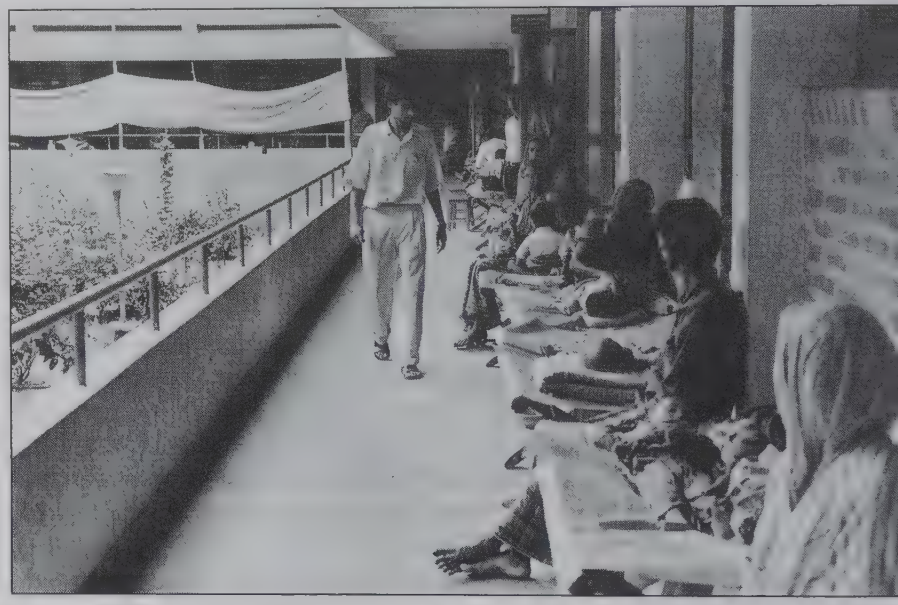
3. 2. Aetiologic Studies:

Two community-based longitudinal studies carried out about 10 years apart examined the relative importance of various enteropathogens in diarrhoeal illnesses of children in Matlab.

In the first study carried out in 1978-79, 197 children aged 2-60

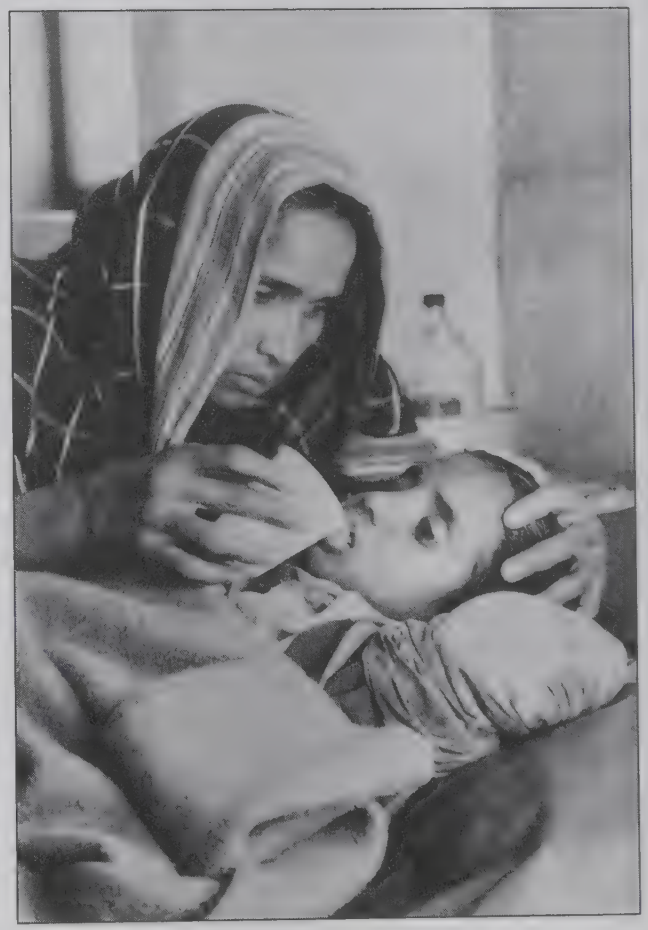
The pediatric diarrhoea ward in the former Matlab Diarrhoea Treatment Centre

A Bari-Mother demonstrates the making of a home-made sugar-salt rehydration solution. Each group of households has such a trained woman capable to help in case of a diarrhoea.



In times of epidemics (every year in March-April), the new Matlab Hos receives so many patients that they have to stay outside in the corridors.

A speedboat ambulance has ensured quick transportation of a patient with cholera to the Matlab Diarrhoea Treatment Centre, a few hours will suffice to put her out of danger.



An anxious mother feeds her dehydrated child with a rice-based oral rehydration solution in the Matlab Diarrhoea Treatment Centre.

TABLE 3

Pathogens associated with diarrhoea in community-based studies at Matlab (percentages)

Pathogen	Period	
	1978-79*	1988-89**
Vibrio Cholerae 01	0.3	0.4
Vibrio Cholerae non-01	1.1	2.9
Shigellae	12.8	8.6
ETEC	26.9	12.2 #
ST	13.0	5.0 #
LT	6.8	6.7 #
ST/LT	7.1	0.6 #
Campylobacter spp.	....	17.6
Salmonella	....	0.1
EAEC	....	34.3 #
Aggregative	....	22.3 #
Diffused	....	10.3 #
Localised	....	2.9 #
EPEC	....	13.5 #
Aeromonas	....	2.0
Plesiomonas spp.	....	0.1
Rotavirus	3.8	4.3 #
Entaemoeba histolytica	0.2	0.4
Giardia lamblia	0.5	2.2
Cryptospordium	....	1.9
No pathogen isolated	49.5	42.1 #

Notes: * : *Black, et al., 1980b*
** : *Baqui, 1990*
# : *Only a sample of specimens were tested for ETEC, EAEC, EPEC and rotaviruses. Proportion with no pathogen was determined based on 297 diarrhoeal patient specimens that were tested for all the above pathogens except EPEC.*
.... : *Not tested*

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months were followed every other day; stool specimens were collected during diarrhoeal episodes and examined for *Salmonella* spp., *Shigella* spp., vibrios, ETEC, *Giardia lamblia, Entamoeba histolytica* and rotavirus (Black, *et al.*, 1982b). Fifty one percent of the 920 diarrhoeal episodes reported had a pathogen isolated.

ETEC (27 per cent) was the most frequently noted agent. *Shigella* (13 per cent) was the second most common pathogen isolated; S. flexneri accounted for 67 per cent of all *Shigella* spp. infections. Rotavirus (4 per cent) ranked third. *V. cholerae*, *E. histolytica*, *G. lamblia* and *Salmonella* spp. each were identified from less than 1 per cent of the patients (Table 3, facing page).

The median duration of various types of diarrhoea was 4-5 days, with the exception of shigellosis, which had a median duration of seven days.

This study also evaluated the nutritional consequences of all diarrhoea and of diarrhoea due to specific enteropathogens. Diarrhoea had a significant inverse relationship with increments of weight during 2-month periods and with increments of length during one year.

Diarrhoea associated with ETEC had a significantly negative effect on bi-monthly weight gain and shigellosis had the strongest negative effect on bi-monthly and annual linear growth. This study concluded that control of ETEC and *Shigella* spp. would not only substantially diminish diarrhoeal morbidity but would also improve the growth of children (Black, *et al.*, 1984a).

The second study followed 705 children aged less than five years from 1988- 89.

This study looked for the following additional enteropathogens: C. jejuni, Aeromonas spp., *Plesiomonas* spp., enteroadhesive *E. coli* (EAEC), enteropathogenic *E. coli* (EPEC) and *Cryptosporidium.* Only a sample of specimens were tested for ETEC, EAEC, EPEC and rotavirus.

Campylobacter spp. (18 per cent) was the most common enteropathogen, followed by *Shigella* spp. (9 per cent). A known enteropathogen was isolated in 58 per cent of the episodes (Table 3) (Baqui, 1990).

To determine a possible special role of particular enteropathogens in persistent diarrhoea, this study examined: a) repeat stool specimens between day 15-17 of the illness for all persistent episodes and b) for each case of persistent episodes, stool samples from an age-matched acute diarrhoeal control and another age-matched healthy control.

Diffusely-adherent *E. coli* and *Cryptosporidium* were the only enteropathogens that were significantly associated with persistent diarrhoea in comparison to acute diarrhoea.

Of the cases with enteropathogens found in stool examinations during the acute stage of the illness, no more than 15 per cent had the same class of organisms identified on repeat examination of the same child during day 15-17 of the illness, suggesting that persistent infection is not commonly associated with persistent diarrhoea. This study also indicated that sequential infections due to different organisms might be a reason for some of the persistent diarrhoeal episodes (Baqui, *et al.*, 1992b).

A one-year study specifically examined the incidence and severity of ETEC and rotavirus diarrhoea (Black, *et al.*, 1981b). ETEC were the most frequently detected enteropathogens; *shigellae* were the second and rotavirus the third.

However, ETEC and rotavirus were more commonly associated with dehydrating episodes. They were found in 31 per cent of all diarrhoeal episodes experienced by children aged less than two

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years, but in 70 per cent of episodes associated with dehydration. Furthermore, these two pathogens were identified in the stools of 77 per cent of young children with life-threatening dehydration seen at the Matlab DTC in the same period. From this association, the study concluded that vaccine development should concentrate on these two enteropathogens to reduce mortality associated with dehydrating diarrhoea (Black, *et al.* 1981b).

3. 3. Transmission Studies

Most of the earlier transmission studies attempted to elucidate the role of water in cholera transmission using a family study design. During the 1973-74 cholera season, surveillance was initiated in neighbourhoods with a culture-confirmed cholera index case and in neighbourhoods with non-cholera diarrhoea as controls.

In neighbourhoods with cholera, 44 per cent of the surface water sources were positive for *V. cholerae,* whereas only 2 per cent of the surface sources were positive in control neighbourhoods. There was an increased risk of infection for families using water from culture-positive sources. These data suggested that use of surface water was important in the transmission of *V. cholerae* (Hughes, *et al.*, 1977; Hughes, *et al.*, 1982). Subsequent studies examined and confirmed the relationship between transmission of cholera and the use of surface water (Khan MU, *et al.*, 1981).

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Diarrhoeal Diseases : The Matlab Experience

Detailed studies of water use by Briscoe, *et al.*, (1978) found that a number of factors affected the sources of water used by village households.

For poor families distance to the water and quarrels with neighbours were important determinants, while for the more wealthy water quality, especially colour, odour, taste, and dirtiness were more influential.

Studies of intra-neighbourhood transmission of El Tor cholera done in 1976 further documented the role of surface water in transmission (Spira, *et al.*, 1980). The pattern appeared to be that contaminated surface water was brought into the household where exposure through drinking and other uses resulted in infection. Food rarely appeared to be a vehicle of transmission in this setting.

The concentration of *V. cholerae* in contaminated samples was low, but it is likely that frequent exposure still resulted in disease, especially in susceptible persons with reduced gastric acid or perhaps those who ingested the vibrios with natural buffers, such as food, which transiently reduced the gastric acid barrier.

This study emphasized the importance of using uncontaminated water sources for all household purposes. Growing evidence for the existence of an aquatic reservoir of *V. cholerae* had led some observers to postulate the existence of two distinct modes of transmission: primary and secondary.

In primary transmission vibrios pass from the aquatic reservoir to humans via edible aquatic flora or fauna, or drinking water. Secondary transmission would then consist of faecal-oral transmission from person to person (Craig, 1988). The mode of transmission of *shigella* infection was assessed by studying neighbourhoods of persons with shigellosis and with non-*shigella* diarrhoea controls (Boyce, *et al.*, 1982).

Use of surface water for drinking was not a risk factor for infection with *Shigella* spp. Families with infection were significantly more likely than uninfected families to have a history of an overnight stay away from home by a family member during the previous week.

Another family study examined the role of food and drinking water in the transmission of ETEC (Black, *et al.*, 1981b). The water sources used by households with one case of ETEC infection were more commonly contaminated with ETEC.

The rate of ETEC isolation varied by water source; ditch (6 per cent), tank (5 per cent), canal (4 per cent), tubewell (2 per cent),

and river (none). ETEC-contaminated cooked food was also found in case households.

To determine the degree of bacterial contamination of traditional weaning foods and to evaluate the role of these foods in the transmission of diarrhoeal diseases, during 1978-79, samples of foods and waters consumed by 40 children were collected. These children were also monitored for diarrhoeal incidence.

Forty-one per cent of the sampled food items and 50 per cent of the drinking water specimens were positive for *E. coli,* an indicator of faecal contamination. Colony counts were approximately 10-fold higher in food specimens than in water samples.

The proportion of a child's food samples that contained *E. coli* was significantly related to the child's annual incidence of diarrhoea associated with ETEC (Black, *et al.*, 1982b).

3.4. Seasonality

Cholera has been very seasonal in Matlab. During the classical period, the peaks occurred in the winter months of November-January. With El Tor cholera, the peak season occurs in September-December. For both El Tor and classical biotypes, there has usually been a small peak in the March-June pre-monsoon dry season (Glass, *et al.*, 1982).

Although the seasonal peaks generally coincide with the hottest mean temperatures, cessation of the monsoon rains and falling river water levels, the exact timing of the peak could not be forecast from historical information on these environmental parameters.

Two community-based longitudinal studies examined the seasonality of diarrhoea in children aged less than five years (Black, *et al.*, 1982a; Baqui, 1990). The incidence of all diarrhoeal episodes showed little seasonal variation. In fact, in both the studies the highest rates were observed at the beginning of the study. Although there were some monthly fluctuations, the rates, by and large, declined during the study year.

The study by Black, *et al.* also examined the seasonality associated with some specific enteropathogens. ETEC diarrhoea occurred most frequently in the hot months between April and September, whereas shigellosis had a higher incidence in the cool, dry months.

The incidence of rotavirus diarrhoea was relatively constant, except for a single peak in December.

3.5. Risk factors

Differentials in diarrhoeal morbidity by household socioeconomic status (SES) were evaluated in 181 children aged less than 5 years of age in a prospective study in two Matlab villages (Becker, *et al.*, 1986). The proportions of days with *Shigella,* rotavirus and total diarrhoea were significantly higher for children in households with a low income. The incidences of shigellosis and of all diarrhoea were higher for children of poorer households.

The study suggested that the incidence and prevalence differentials by SES might be a reflection of differences in household hygiene and/or in children's nutritional status.

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A prospective study carried out from August 1975 to July 1976 in 5,775 children aged 1 month to 10 years explored the association of measles and diarrhoea (Koster, *et al.*, 1981).

This study documented that measles substantially increased the number of subsequent episodes of diarrhoea, especially those of prolonged duration.

In fact, prolonged diarrhoea during or in the month following measles seems to play an important role in mortality. Children

with measles and prolonged diarrhoea had a case fatality rate six-fold higher than children with measles alone and 12-fold higher than prolonged diarrhoea alone, demonstrating the synergy of the two conditions in regard to mortality.

Several community-based longitudinal studies examined the association between undernutrition and diarrhoeal morbidity (Chen, *et al.*, 1981; Black, *et al.*, 1984b; Bairagi, *et al.*, 1987; Chowdhury, *et al.*, 1990; Baqui, *et al.*, 1993). The studies by Chen, *et al.*, Black, *et al.* and Bairagi *et al.* reported that under-nutrition was not a major predictor of diarrhoeal incidence.

The recent study by Baqui, *et al.* reported a modest association between undernutrition as assessed by weight for height status and the incidence of diarrhoea. In this study, a decline in Z score of 1 in weight for height status was associated with 22 per cent excess risk of diarrhoea.

This association between undernutrition and the incidence of diarrhoea persisted after controlling for the effects of potentially confounding factors, such as age, sex, SES and prior diarrhoeal experience. Chowdhury, *et al.* and Baqui, *et al.* also observed a strong association between diarrhoeal illness in a preceding period and further diarrhoea in the following period.

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Diarrhoeal Diseases : The Matlab Experience

Several studies done in Matlab (Black, *et al.*, 1984b; Bairagi, *et al.*, 1987; and Chowdhury, *et al.*, 1990), observed an increased average duration of diarrhoeal episodes in undernourished children. In the study by Black, *et al.*, children in low weight for length (<80 per cent) had diarrhoeal episodes of more than 50 per cent longer durations than their better-nourished counterparts.

This study also demonstrated that poor nutritional status was an important determinant of the duration of diarrhoea associated with specific enteropathogens.

Using weight for length Z scores prior to the illness, duration of ETEC was more than two-and-one-half times longer in children less than -2 Z scores and four times longer for those less than -3 Z scores. Similarly, the duration of shigellosis was three times longer in the most malnourished group.

Two prospective studies related cellular immune defects (assessed by a battery of skin test antigens) to diarrhoeal morbidity (Koster, *et al.*, 1987; Baqui, *et al.* 1993). Koster, *et al.* studied 152 children aged 12-120 months for a 12-month period, January-December 1975 and observed that anergy was associated with a 58 per cent increased attack rate and an 83 per cent increased duration of diarrhoeal episodes in children older than 36 months. This effect was independent of the effect of nutritional status.

Recently, Baqui, *et al.* re-examined this association in a larger cohort of children aged less than 5 years and observed a 40 per cent excess diarrhoeal incidence in anergic children. This association remained the same after simultaneously controlling for age, sex, nutritional status by anthropometry, SES and history of diarrhoea in the previous interval.

The authors concluded that in their study children, cell-mediated immune status and nutritional status were independent risk factors for the occurrence of diarrhoea.

The same study also examined the association of both nutritional status and cell-mediated immune status with the occurrence of persistent diarrhoea. Under-nutrition, as assessed by weight for height status, was significantly associated with the incidence of persistent diarrhoea.

A decline in Z score of 1 in weight for height status was associated with an 87 per cent excess risk of persistent diarrhoea (Odds Ratio=1.87, 95 per cent Confidence Intervals=1.31-2.67).

Thus, compared to children at zero Z-score weight for height, children at -2 Z-scores would have 3.5 times higher rate and

children at -3 Z-scores would have 6.5 times higher rate of persistent diarrhoea.

This strong association between under-nutrition and the incidence of persistent diarrhoea persisted after controlling for age, sex, SES and history of diarrhoea in the previous interval. Cell-mediated immune deficiency, as assessed by a multiple antigen skin test, was also associated with an increased incidence of persistent diarrhoea.

Children with cutaneous anergy had a two-fold increased risk of persistent diarrhoea compared with children who reacted to at least one of the skin tests. Controlling for age or nutritional status or both did not change the strength of the association, nor did controlling for a history of diarrhoea in the previous interval. These data suggest that cell-mediated immune deficiency, independent of nutritional status, is an important marker of risk for persistent diarrhoea.

Baqui, *et al.* also observed a strong association between diarrhoeal illness in a preceding period and the incidence of persistent diarrhoea in the following period and offered two hypotheses to explain this association. These are:

1) acute diarrhoea in some way alters host factors which increase the risk of persistent diarrhoea; and/or

2) there exists natural heterogeneity in diarrhoea rates in children living in community which may be determined by a myriad of variables, many of which may not be measurable. Diarrhoea in the previous interval may simply serve as a surrogate measure for the unmeasurable variables.

A unique risk factor was observed for cholera, but not other diarrhoeal illnesses in Matlab. Cholera patients were twice as likely to have blood group O as community controls (Glass, *et al.*, 1985). Persons of blood group O appear to have more severe disease. This association has been hypothesised to result in evolutionary pressure leading to the extremely low prevalence of O group genes in the population living in the cholera-endemic Gangetic Delta, including Bangladesh.

3. 6. Mortality due to diarrhoeal diseases

The death-reporting system in the Matlab DSS area has been operating since 1966. Prior to 1986, the presumed cause of death was determined from a retrospective open-ended interview with relatives, carried out by experienced, but non-medically trained, interviewers and classified by office workers.

The cause list contained a number of types of classification: specific diseases (measles, tetanus); associated circumstances (malnutrition, child birth); major symptoms (jaundice, dysentery); systems affected (respiratory, venereal); unknown; and "others" meaning that a specific cause could be assigned, but the death does not fit into one of the coding categories (for example: cancer).

Furthermore, there were situations when two causes would be equally valid: for example, 'liver disease' and 'jaundice' for infectious hepatitis. There was no documentation of decision rules which could be used in such cases. The potential for respondent, interviewer and classifier bias was obvious (Zimicki, *et al.*, 1985; D'Souza, 1985). Appreciation of these problems called for a change in the cause-of-death reporting system.

In the beginning of 1986, DSS interviewers were retrained, and refreshed once a year thereafter (see Chapter 5). The training focused on the need to collect relevant information, as precisely as possible. Interviewers were asked to write descriptive information in Bengali. Completed death forms were taken to the central office and read by medically-trained staff.

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Diarrhoeal Diseases : The Matlab Experience

During the first year of the modified system, each death form was reviewed by a panel of 3 physicians of the Matlab health project who were experienced in the local health terminology.

They were asked to make a diagnosis and majority rules were applied, i.e. if 3 or at least 2 physicians agreed, their diagnosis was retained. If the 3 disagreed, death forms were returned to the field for more information, and then reinserted in the system (Fauveau, *et al.*, 1991a). Interpretation of Matlab cause of death data should be made in light of this background.

Using the 1975-77 Matlab DSS cause of death data, the epidemiology and causes of child death were analysed by Chen, *et al.* (1980b). The most significant causes of death were diarrhoea (watery and dysentery), tetanus, measles, fever, and respiratory diseases.

Of an infant mortality rate of 142.6/1,000 live-births, neonatal tetanus (37.4/1,000), diarrhoea (19.6/1,000), and respiratory diseases (10.4/1,000) were the most important identifiable causes.

The 1-4 year old mortality averaged 34.3/1,000. Diarrhoea (15.1/1,000), measles (4.5/1,000), fever (2.9/1,000), respiratory disease (1.6/1,000) accounted for most 1- to 4-year deaths. Female deaths exceeded male deaths for all ages after the neonatal period.

This study concluded that a few basic health interventions (ORT and immunization) could result in substantial reduction in under-five mortality.

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Diarrhoeal Diseases : The Matlab Experience

A community-based longitudinal study of 5,775 children carried out between 1975 and 1976 explored the role of diarrhoea in contributing to measles-associated mortality (Koster, *et al.*, 1981). Measles and diarrhoea appeared to interact synergistically to increase mortality, prolonged diarrhoea was the most common complication in fatal cases.

To identify clinical determinants of a fatal outcome in dysentery, a case-control analysis was done with patients hospitalized in 1980 at the Matlab DTC (Mitra, *et al.*, 1990). The risk factors shown to be significantly associated with deaths were: longer median duration of illness, being a female, signs of respiratory infection and severe malnutrition.

Another study analysed the patterns of diarrhoeal deaths during 1966-87 in the Matlab DSS area (Shaikh, *et al.* 1990). Mortality patterns were analysed in relation to age, sex, seasonality and yearly variation.

The overall death rates due to diarrhoeal diseases and other causes fluctuated during the period. Diarrhoeal death rates were between 2 and 4 per 1,000 population except during the war (1971) and famine (1974-75) years.

On the average, more than 20 per cent of all deaths were associated with diarrhoea. Between 1978 and 1987 the highest diarrhoeal death rates were observed in children aged 1 to 4 years. Persistent diarrhoea caused more deaths than acute diarrhoea, except in infants (Table 4, facing page). The relative importance of diarrhoea as a cause of death did not diminish over time. This paper suggested the need to improve the existing diarrhoea treatment programme in the Matlab area.

Two recent analyses attempted to distinguish further the contribution of different types of diarrhoea to infant and child mortality in the Matlab area during 1986-87 (Fauveau, *et al.*, 1991b; Chowdhury, *et al.*, 1991).

Acute watery diarrhoea was associated with 11 per cent of all deaths among infants of 1-11 months and 5 per cent among children aged 1 to 4 years. Acute non-watery diarrhoea, including bloody dysentery, was associated with 16 per cent of all deaths in children aged 1 to 4 years. In this age group, persistent diarrhoea was associated with 63 per cent of all diarrhoeal deaths and 34 per cent of all deaths.

Further analyses of these mortality data suggest that most of these deaths associated with persistent diarrhoea are in children with severe malnutrition (Fauveau, *et al.* 1992a).

Another study in Matlab indicates that malnutrition is an important risk factor for mortality (Roy, *et al.*, 1983). Children visiting the DTC were classified using discharge weight into three nutritional status categories.

Severely malnourished children, even after successful treatment of the diarrhoea episode that brought them to the DTC, had a 14-times-greater risk of death in the subsequent year.

These deaths were predominantly in the three months after discharge, indicating the need for more attention to nutrition, including during and following diarrhoeal episodes.

TABLE 4

Comparison of death rates (per 1,000 population) due to diarrhoea and other causes before and after the introduction of MCH-FP programme at Matlab, 1966-87.

	Pre-intervention period 1966-77					Intervention (MCH-FP vs Comparison) period 1978-87									
	Age (years)					Age (years)									
	<1	1-4	5-9	10+	All	<1		1-4		5-9		10+		All	
Cause of death						M	C	M	C	M	C	M	C	M	C
Diarrhoea	10.5	11.0	1.5	2.5	3.8	5.7	5.7	6.8	10.4	0.8	1.2	1.1	1.7	1.9	4.2
Acute diarrhoea	4.7	0.8	0.3	0.2	0.5	3.4	3.3	1.2	2.6	0.3	0.5	0.2	0.4	0.5	1.1
Persistent diarrhoea	5.8	10.3	1.3	2.3	3.3	2.2	2.4	5.2	7.8	0.5	0.8	0.8	1.3	1.4	3.1
Diarrhoea as a per cent of all deaths	8	47	39	31	26	6	5	34	56	26	27	14	20	16	20

Note: M = MCH-FP, C = Comparison
This table has been adapted from Shaikh, et al. (1990)

CONTINUED...
Diarrhoeal Diseases : The Matlab Experience

4. INTERVENTION STUDIES

Apart from cholera vaccine field trials, some of the earliest efforts to reduce infectious diarrhoeal disease incidence at rural Matlab were tube-well water improvement programmes (Curlin, *et al.*, 1977). Several studies measured the impact of hand-pumped tubewells on diarrhoeal incidence and uniformly concluded that drinking tubewell water was not associated with a reduction in overall diarrhoea rates or in the hospitalization rates for cholera or shigellosis (Sommer, *et al.*, 1972; Levine, *et al.*, 1976b; Briscoe, 1977).

This led to the hypothesis that the use of tubewell water only for drinking purposes does not protect individuals against cholera; and/or the small amount of protection afforded by drinking bacteriologically safe water is overwhelmed by the exposure to polluted surface water through bathing, food preparation, and utensil washing or by continued partial use of surface water for drinking (Briscoe, 1977; Briscoe, 1978b; Spira, *et al.*, 1980).

Briscoe, *et al.* felt that making alternative sources of uncontaminated pure water available would not be adequate and suggested that water improvement programmes should have an educational component stressing the need to use uncontaminated water for all purposes, or at least for all household uses.

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The distribution of sucrose-electrolyte oral therapy packets by community-based workers was evaluated in 1977 in a Matlab population of 157,000 (Chen, *et al*, 1980a). A similar population of 134,000 served as a comparison group. The locally produced one-litre packets showed satisfactory chemical composition with a shelf-life of up to 3 months and a cost of US$ 0.05.

Most patients used one packet for each episode of diarrhoea; 13 per cent of children and 15 per cent of the adults used two packets. The electrolyte composition of the oral fluids prepared by field workers and mothers showed substantial variation, but no hyperconcentrated solutions were noted.

A comparison of the hospitalization rate from the two study areas showed a 29 per cent reduction in hospitalization for diarrhoea during the four months of distribution (Chen, *et al.*, 1980a).

To assess the relative acceptability, effectiveness, safety and impact on nutritional status of the WHO-recommended glucose-electrolyte solution and of a home-made solution of common salt *(labon)* and brown sugar *(gur)*, a field trial of ORT was carried out between 1979 and 1980 (Yunus, 1982).

The distribution and promotion of ORS packets started in half of the MCH-FP area and half of the comparison area in 1979. Between 1979 and 1980, *labon* and *gur* were distributed in the remaining half of the MCH-FP area.

In the MCH-FP area, community-based workers provided health and nutrition education to all mothers and identified a woman volunteer called a Bari Mother in each cluster of households surrounding a courtyard *(bari)*, and trained her in the promotion and distribution of ORS packets (Chakraborty, *et al.*, 1981).

The study observed that village mothers with little or no education could effectively prepare and administer ORT, and that more than 90 per cent of the diarrhoeal patients accepted either form of ORT at home (Yunus, *et al.*, 1979).

In the comparison area, ORS packets were distributed by field workers during their routine visit.

The serum electrolytes for persons treated for diarrhoea at home with prepackaged or locally available sugar and salt solutions and for persons with diarrhoea who received no ORT but were treated according to local customs, were measured.

No detrimental effect was found for persons treated with ORT at home; the rates of hyponatraemia and hypokalaemia were significantly lower for persons who took estimated appropriate

volumes of ORT than for those who took less than appropriate volumes or for persons who did not receive ORT. The finding suggested that ORT administered in rural homes in Bangladesh was safe and effective (Snyder, *et al.*, 1982).

Analysis of Matlab cause of death data for the period 1978-87 revealed that the diarrhoeal death rate was comparatively lower in the MCH-FP area than that in the comparison area (Shaikh, *et al.*, 1990). More recently, an attempt to evaluate the impact of ORT on diarrhoeal mortality in Matlab was not conclusive (Fauveau, *et al.*, 1992b).

Observing the trends of diarrhoea-related mortality among infants between 1976 and 1988 (as assessed by DSS workers), the authors reported an absence of difference before and after the implementation of the Matlab ORT programme, in both MCH-FP and comparison areas.

An intensive measles immunization programme began in the MCH-FP area in 1982. To ascertain whether measles vaccination was associated with reduced mortality among Matlab children, two studies were conducted, one a retrospective case-control study (Clemens, *et al.*, 1988d), and the other a longitudinal cohort analysis (Koenig, *et al.*, 1990, see Chapter 11).

Vaccinated children experienced mortality risks over 40 per cent *lower* than their unvaccinated counterparts (Koenig, *et al.*, 1990). Deaths attributed to diarrhoea, were significantly reduced, but those associated with other conditions were not (Clemens, *et al.*, 1988d).

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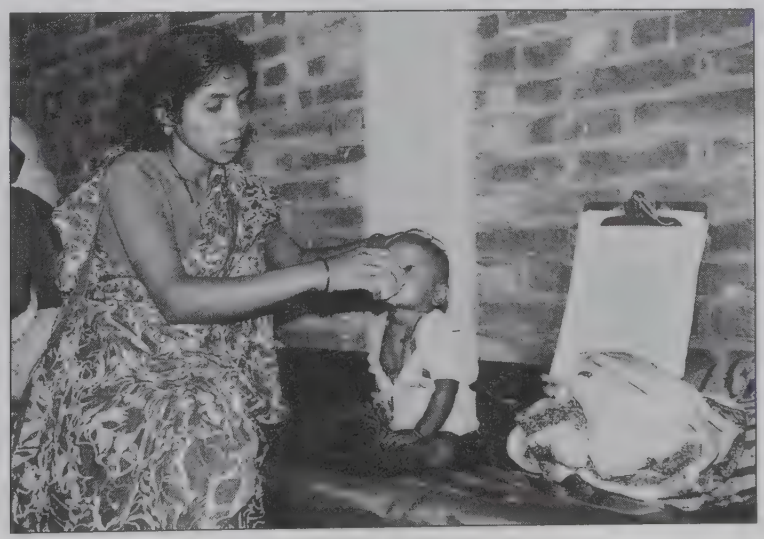

Oral Rehydration Solution: a safe, effective answer to diarrhoea in rural Bangladesh

CONTINUED...
Diarrhoeal Diseases : The Matlab Experience

CHAPTER 9

Diarrhoeal Diseases : The Matlab Experience

Abdullah H. Baqui, Robert E. Black, Amal K. Mitra, Hafiz R. Chowdhury, K. Zaman, Vincent Fauveau & R. Bradley Sack

Lessons learned and recommendations...

The Matlab project was originally established as a field site for evaluation of existing and new cholera vaccines. Over the years, a number of major cholera vaccine field trials have been conducted without much success.

The most recent field trial, evaluating two oral cholera vaccines, concluded that both vaccines provided 50 per cent protection up to three years, but a lower rate of protection was observed in children aged less than 5 years. An optimal vaccine still does not exist for a disease which has been so exhaustively studied. The search for improved cholera vaccines must continue.

Several clinic- and community-based epidemiological studies have clearly demonstrated that ETEC and rotaviruses are responsible for the majority of dehydrating diarrhoeas in children aged less than five years. Dysentery, particularly shigellosis, is also an important cause of morbidity and mortality. These findings suggest that, in addition to cholera vaccines, efforts should also be directed towards development of vaccines against ETEC, rotaviruses and Shigella.

Despite substantial evidence of the effectiveness of ORT in clinical settings, adequate use of ORT in the community is problematic. While 91 per cent of the patients attending the Matlab DTC reported that they had prior experience of using ORT, about half of the patients without clinical dehydration did not use ORT but came to the DTC instead. Others used quantities of ORT which were inadequate to affect the development of dehydration.

Further research is needed to identify ways to close the large gap between ORT knowledge and practice. This could significantly reduce diarrhoea-related hospitalizations and reduce a heavy economic burden on the health services.

Although there has been a decline in diarrhoeal death rates at Matlab over time, the rates are still high. When diarrhoeal deaths are dis-aggregated into deaths due to acute watery diarrhoea, dysentery, or persistent diarrhoea, it is evident that persistent diarrhoea and dysentery are much more important causes of death than acute watery diarrhoea in children over one year of age.

This finding suggests that the strategy for diarrhoeal control programmes needs to be broadened to include antibiotic treatment of dysentery and nutritional interventions to prevent or manage persistent diarrhoea.

Programmes should reinforce the use of ORT, particularly in infants, since acute watery diarrhoea appears to be more important in terms of incidence, hospital admission and death than other types of diarrhoea in this age group. ORT is indicated but is not sufficient in clinical dysentery (Rabbani, et al., 1983).

Antibiotic management of dysentery, complicated by the development of resistance of Shigella spp. in some areas, is needed and should be part of a broader approach to rational drug use for paediatric infectious diseases.

Persistent diarrhoea is a complex and multifactorial syndrome. In a recent prospective study of children aged less than five years in Matlab, undernutrition and anergy were important independent risk factors for the occurrence of persistent diarrhoea. Diarrhoeal case-fatality rate has been shown to be higher in under-nourished children (Briend, et al., 1987). Diarrhoea is a nutritional disease, and improvement of nutritional status would reduce diarrhoea-associated deaths.

The finding that measles and diarrhoea interact synergistically led to the supposition that the introduction of measles vaccination could have a major impact on child survival. Subsequent studies demonstrated that measles vaccination is an important strategy capable of reducing diarrhoeal, as well as overall, under-five mortality.

Cell-mediated immune deficiency, independent of nutritional status, is an important risk factor for the occurrence of diarrhoea, particularly persistent diarrhoea in children aged less than five years in Matlab. Immunosuppression, perhaps persisting for months or years, may be one of the mechanisms by which measles leads to higher child mortality for a prolonged period after the illness and cell-mediated immunity may likewise be depressed following a variety of viral and bacterial infection (Kauffman, et al., 1976; Kantor, 1975). Cell-mediated immune deficiency may also occur with deficiency in single nutrients, such as vitamin A, pyridoxine, folic acid, iron and zinc (Beisel, 1982).

Transient anergy in an apparently healthy child following an infection may predispose the child to another infection and may lead to a vicious cycle of repeated infection, anergy, and deteriorating nutritional status. Therefore, interventions restricted to protein-calorie supplementation alone are likely to have limited impact on the control of undernutrition and persistent diarrhoea, and the role of micronutrient deficiencies must be considered more systematically.

The studies done at Matlab have contributed greatly to global knowledge about the enteropathogens causing various clinical diarrhoeal syndromes, their routes of transmission and risk factors, and means of control.

The findings on diarrhoea case management and preventive interventions, including ORT, provision of safe water, measles vaccines, appropriate antibiotic use, nutritional interventions, have demonstrated ways to improve child survival worldwide.

Application of these technologies in the health services have resulted in reduced morbidity and mortality in the Matlab area. Further efforts directed towards the prevention and management of nutritional problems and related persistent diarrhoea offers even greater potential for improved survival and healthy life.

Applied research will be needed to continue to document the important lessons that can be derived from delivering health services and conducting interventions in Matlab.

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CHAPTER 10

Acute Respiratory Infections in Matlab: Epidemiology, Community Perceptions and Control Strategies

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Acute respiratory infections (ARI) are a major cause of morbidity and mortality among children aged less than five years in non-industrialized countries (Stansfield, 1987; Leowski, 1986; Pio, 1985). Research indicates that bacterial aetiologies of severe acute lower respiratory infections (ALRI) are more common in these parts of the world (Shann 1986, 1984). However, vaccines against the most common bacteria in the very young are not yet fully developed.

Other preventive measures aimed at decreasing the risk of ALRI, such as immunization against measles and pertussis, vitamin A supplementation, and promotion of prolonged breast feeding, are not capable of preventing deaths from severe bacterial pneumonia, once it occurs. In the absence of comprehensive strategies for preventing childhood pneumonia, community-based management of cases has been advocated (World Health Organization, 1986a).

This chapter reviews findings from Matlab relating to the epidemiology, community perceptions, and control of ARIs with a particular focus on ALRIs. First, details of the implementation and evaluation of ALRI interventions in the Matlab Maternal and Child Health and Family Planning (MCH-FP) Programme are described. Then, issues with programmatic relevance and policy implications are discussed keeping in view both global and national ARI Control. Finally, within the context of this past experience, priorities for future research are outlined.

1. BACKGROUND

The focus of the Matlab MCH-FP Programme was broadened in the mid-eighties to include more interventions directed at maternal and child health and survival. These services are provided by female community health workers (CHWs) to women of child-bearing age and children aged less than five years.

The interventions standardized throughout the MCH-FP area in the mid-eighties included full immunization against the six common childhood diseases; promotion of breast feeding; six monthly vitamin A capsule distribution to children; and screening and referral of the malnourished children for nutritional rehabilitation.

The ALRI Control Project was initiated in 1988 in the context of these pre-existing interventions with the goal of decreasing morbidity and mortality of children suffering from pneumonia.

Though initial research in Matlab was primarily concentrated on diarrhoeal disease, data collected early on demonstrated that ALRI was also a serious cause of child morbidity and mortality.

An analysis of longitudinal demographic surveillance data collected from 1975 to 1977 identified respiratory disease as the third most common cause of death among infants, after diarrhoea and neonatal tetanus (Chen, *et al.*, 1980). Longitudinal morbidity surveillance in 1978-79 documented upper respiratory infections as the most common illness of children aged 2-60 months (Black, *et al.*, 1982). The prevalence of pneumonia in this age group was 0.3 per 100 child-days.

The pneumonia incidence rate in infants in this study was 0.57 episodes per child-year (de Romana, *et al.*, 1989) which is among the highest documented in numerous studies from the region (Rahmathullah, *et al.*, 1991; Bang, *et al.*, 1990; Pandey, *et al.*, 1985; Zhang, *et al.*, 1985).

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Subsequent cause of death studies in Matlab (Fauveau, *et al.*, 1991, 1990) and in Teknaf, a southern district of Bangladesh (Spika, *et al.*, 1989), confirmed the importance of ALRI as a threat to infant and child survival in Bangladesh.

The Matlab analysis of verbal autopsy data, covering the period of 1986-87, identified ALRI as the main cause for 38 per cent of all post-neonatal deaths and 15 per cent of all deaths among children of one to four years of age (Fauveau, *et al.*, 1991).

In Teknaf, ALRI was the leading cause of death among children aged 1-59 months from 1982 to 1985, with half of these deaths occurring in the first six months of life (Spika, *et al.*, 1989).

Several studies have documented some of the risk factors associated with a higher frequency of ALRI or ALRI-specific mortality in Matlab and Teknaf. The age distribution of pneumonia deaths in Matlab was found to be highly skewed toward the first year of life (Figure 1, facing page, borrowed from Fauveau, *et al.*, 1992).

Other studies also identified the higher risk of ALRI disease and/or death among children aged less than one year (Spika, *et al.*, 1989; Black, *et al.*, 1982), among children suffering from malnutrition and measles (Spika, *et al.*, 1989), and among children of lower socio-economic status (Becker, *et al.*, 1986).

Poverty and malnutrition often go hand in hand in Matlab, affecting a large proportion of the population; yet solutions are difficult and complex.

On the other hand, the challenge of measles prevention is much more straightforward and was, to a large extent, achieved in the MCH-FP area prior to initiation of the ALRI Control Project in Matlab in 1988 (Fauveau, *et al.*, 1990).

The main strategy of the Matlab ALRI intervention, therefore, was that of community-based management of ALRI.

This case-management approach was adapted from the early World Health Organization guidelines (World Health Organization, 1986b, 1985). Though the WHO diagnostic criteria have been modified in recent years, the mainstay of this approach continues to be community-based detection, diagnosis, and antibiotic therapy of childhood pneumonia.

Both research and service activities formed the backbone of the initial ALRI project. The service component was aimed at decreasing pneumonia-related morbidity and mortality.

The research goals of the project were to learn more about the epidemiology of childhood pneumonia in Matlab; to evaluate the impact of the intervention on mortality and morbidity; to study the process of programme operation; and to investigate factors related to service utilisation. Several activities were initiated to achieve these goals including collection of surveillance and treatment data.

2. EPIDEMIOLOGY

Active surveillance was conducted in the MCH-FP area monthly by the CHWs asking mothers of all children aged less than five years about symptoms of cough and/or fever associated with fast breathing and/or chest indrawing.

Acute cases were detected actively by the CHW at the time of her monthly pre-scheduled visit to a house, or passively, by a family member or neighbour contacting her for assistance at any other time. Current pneumonia cases could also be detected when the CHW visited to collect surveillance data on the mother.

For cases seen to be acute, the CHW recorded the date, the duration of symptoms, her assessment of severity, and her management. An episode-based data set was created, combining this information with clinic and hospital-based data on ALRI cases.

This data was used to calculate rates of disease, treatment, and case fatality from ALRI among children served by the ALRI Control Project.

Deaths due to childhood ALRI in the two years before the ALRI intervention were skewed toward the youngest, with over 60 per cent of the ALRI deaths occurring in children aged less than six months (Figure 1, overleaf).

As indicated in Figure 2 (overleaf), most deaths attributed to pneumonia (post-measles pneumonia excluded) occurred during the dry and cold months between December and May.

After surveillance was initiated in the MCH-FP area, both incidence and attack rates of pneumonia were found to be inversely related to age, being highest in infants.

Repeat episodes, represented by differences in the incidence and attack rates, comprised 36 per cent of all episodes. Treatment and admission rates were highest in children of 1-11 months old, when considering all children at risk. This age group experienced hospitalization in a higher proportion of managed episodes than older children.

Overall case-fatality rates were highest in infants. Rates of disease were significantly higher in males. Males were also more likely than females to receive hospital care.

3. COMMUNITY PERCEPTIONS OF ALRI

A qualitative study of community perceptions and behaviour relating to childhood pneumonia was undertaken in 1989. Methods of data collection included case history interviews of mothers of children with pneumonia; and focus-group discussions with mothers, grandmothers, and traditional birth attendants using scenarios developed from the case histories.

This study was initiated in an effort to better understand barriers to programme effectiveness. Little information of this nature was available to inform development of appropriate educational interventions to increase service use.

The importance of these efforts was accentuated in a preliminary evaluation indicating that less than 20 per cent of the children who died with pneumonia in the first year of the project were seen prior to death by a project health worker.

A variety of local terms commonly used were identified by community respondents interviewed about ALRI-like disease. These terms and concepts, in addition to allopathic medical

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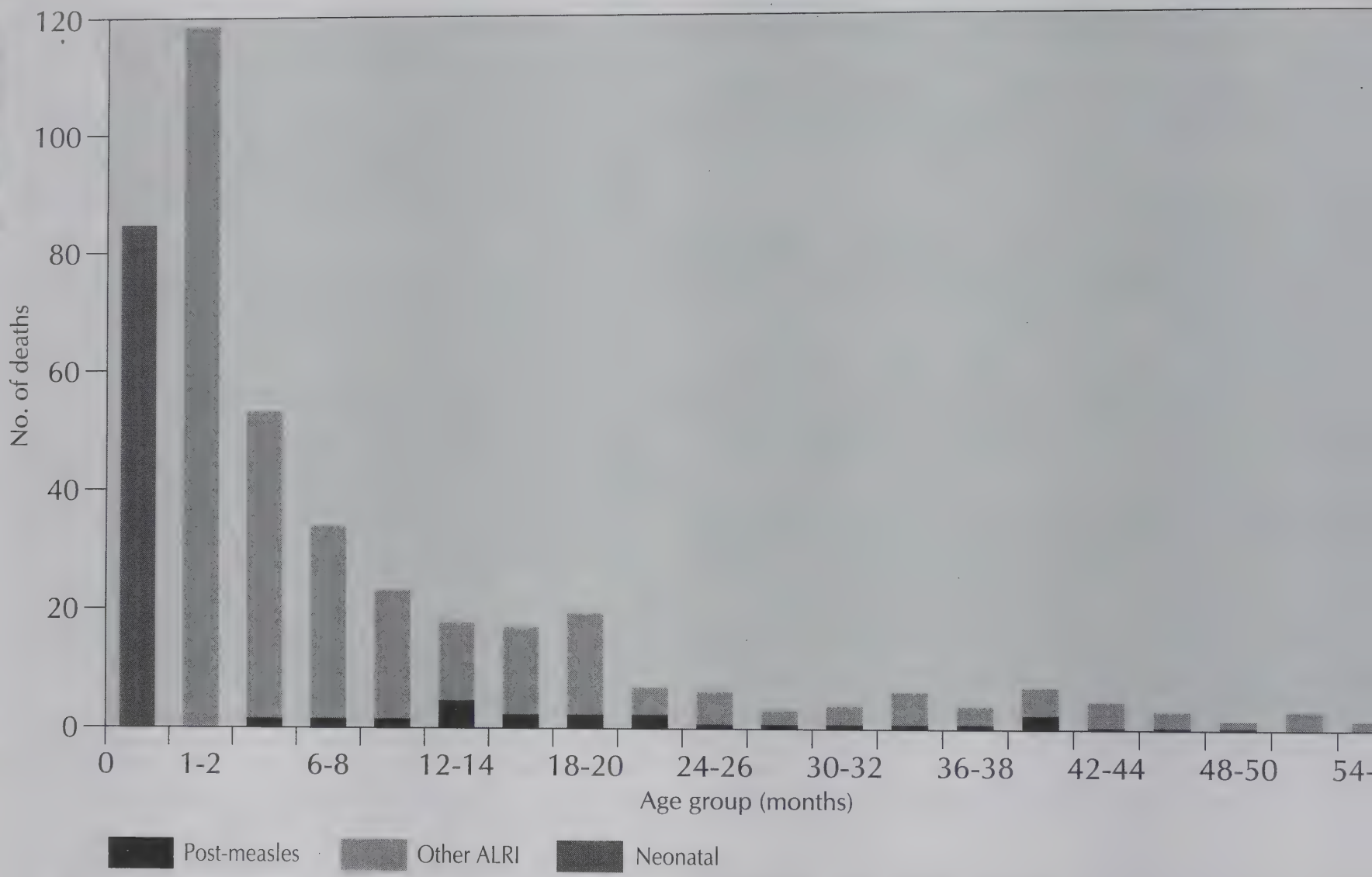

Fig. 1 : Age distribution of deaths from acute lower respiratory infections in the Matlab comparison area, 1986-

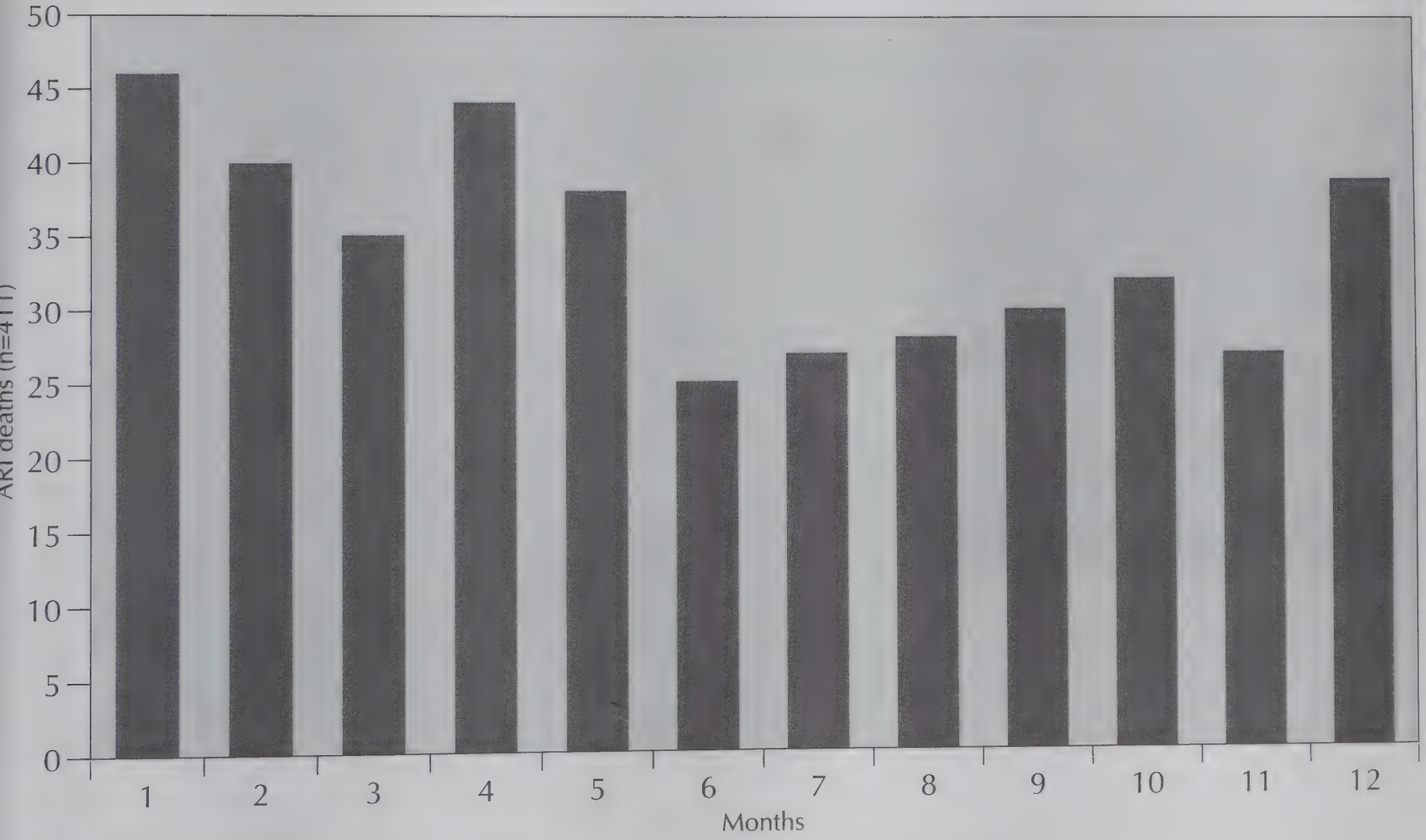

Fig 2 : Seasonality of ARI Deaths in Children

Measles Excluded

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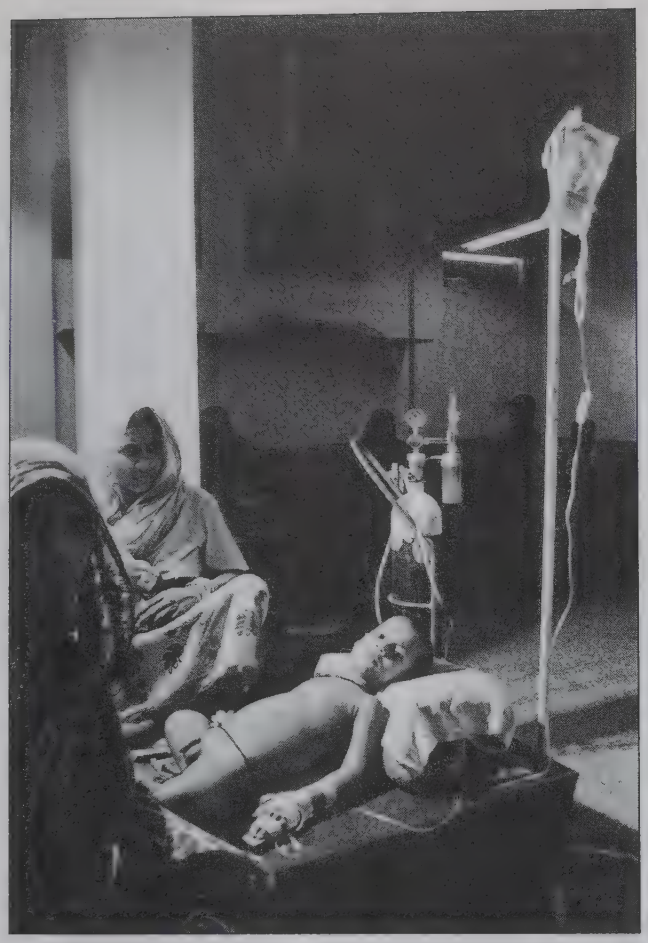

Even through all available interventions were used, this boy died shortly after the picture was taken.

The Acute Respiratory Infection (ARI) ward in the new Matlab ICDDR,B Hospital. Pneumonia is the most frequent cause of death among infants aged one month to eleven months.

terms, were found to be widely used and recognised; and the choice of terms used to describe the disease was often a good predictor of the mother's behavioural response.

All participants in the mothers' focus groups associated pneumonia with the syndrome of fever, cough, laboured and fast breathing, and chest retractions described in the scenario. Sixty per cent of the participants in the focus groups with grandmothers recognized these signs as pneumonia.

Signs of severe pneumonia listed by all the groups were chest retraction, laboured breathing, lethargy, and inability to feed. These signs were recognised by almost all women, who also responded to them by seeking some form of treatment from outside practitioners.

In particular, chest retractions and breathing difficulty were generally understood to be life threatening and beyond the scope of home treatment. Rapid breathing was mentioned less frequently in focus-group discussions, though almost all mothers being interviewed about the course of their child's current illness listed this sign.

The constellation of signs and symptoms attributed to pneumonia was perceived in contrast to *"alga"*, thought to be due to attack by evil spirits, most commonly in young infants.

The group participants reported that while respiratory symptoms and signs are often present in *"alga"*, it is usually diagnosed by the presence of seizure activity, eyes rolling back in the head, and "black" colouration of the child. *"Hapani"*, or wheeze, on the other hand, presents very much like pneumonia except without fever and is self-limiting in most cases, though it may "develop into" pneumonia.

Most women in both interviews and focus groups attributed the initial illness to either the child's or the nursing mother's exposure to cold[1]. A minority believed that attack by spirits, bad winds, or the evil eye had caused the disease, and these women identified the illness as *"alga"*.

This aetiology was more commonly assumed in very young infants, particularly neonates. Treatment delays are worsened in these high risk cases since the ideal treatment is assumed to be spiritual rather than medical. Whether attributed to chilling or to supernatural attack, it was thought that a nursing mother would pass the illness to the child through breast-milk if she herself became "exposed". In some cases, mothers themselves reported withdrawing the breast if they themselves became ill.

Many respondents also stated that the disease progressed to a more serious form because mucus was retained in the chest, where it stuck or hardened, and became "attached to the chest". Home care, therefore, emphasized protecting the mother and child from cold and also attempting to soften and encourage expulsion of the mucus by rubbing warmed mustard oil mixed with garlic juice on the child.

Among those who thought the illness was due to cold, either the mother or, if weaned, the child would be constrained to avoid "cold" foods and chilling of the body by wind or water. Almost all ALRI-like symptoms were initially treated with home remedies and dietary measures, and many then consulted a

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[1] *"Exposure to cold" was defined broadly by most respondents to include: 1) environmental cold which might be atmospheric, and/or transmitted by prolonged exposure to water on the body or by drinking tube well water when not accustomed, and/or by exposure to mud as when a child is playing on the ground: 2) food which is inherently cold and/or cold in temperature and/or "stale"; 3) sickness of the child with a common cold ("thanda johr") but not exposure to others with a common cold. The concept of contagion did not seem to be recognised, though the mother could pass on any number of evils and give "cold exposure" to the child through her breast-milk.*

spiritual healer *("kobiraj")* within 24 hours. Allopathic treatment was most likely to be considered with rapid worsening of symptoms. One of the factors most strongly associated with the decision to seek allopathic treatment early on was previous experience with a successfully treated case of pneumonia.

In the case history interviews, women who had seen such a case, either in their own or a neighbour's family, immediately recognised their child's disease as pneumonia. Most of these respondents reported seeking allopathic treatment, either from the CHW or village doctor, as soon as they thought the child had pneumonia.

Although a few may have recognized pneumonia solely on the strength of teaching given by the CHW on prior home visits, three case history mothers said that, though they had been told about pneumonia by the CHW, they had forgotten or had not thought to make the connection when their own child fell ill. Usually, these women turned to a family member (particularly the mother-in-law) for diagnosis and advice when the emergency arose.

A number of external constraints were reported to deter women from seeking care when their sick child was referred for treatment. Many women were forced to refuse referral because there was no one available to take over household chores, particularly the care of other children in the home.

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Those women who did act on the health worker's advice regarding referral were able to arrange substitute care (however inadequate) for their other children. Mothers without supportive family members were, therefore, disadvantaged, suggesting a significant effect of household composition on health care use.

In addition to these difficulties, women also experienced internal constraints, beliefs, and attitudes which inhibited them from seeking or allowing hospitalization of their children. Seeking treatment outside the immediate neighbourhood required a temporary abandonment of *"purdah"*.

One woman remarked that her in-laws refused to allow her or her sister-in-law to take their sick children for care at Matlab. It would be socially and religiously unacceptable for these young mothers to travel alone to the hospital, where they would be seen by unknown men. Even among the mothers whose children were admitted to hospital, two said they had delayed travelling until someone trustworthy was available to accompany them.

Another concern related to *"purdah"* was the common belief that going "outside", especially at certain times of day and in certain seasons, would invite an attack by disease agents. These agents could be supernatural, such as evil winds or spirits, or natural, in so far as travelling during monsoon or winter would expose the mother and child to cold wind and water.

One mother avoided seeking outside care because it would have meant travelling to Matlab by watercraft in the rain and cold. Such a journey, she felt, would actually expose the sick child to more danger than benefit.Strict observance of *"purdah"* and fear of travel are based in part upon two pillars of health belief: 1) disease in a nursing child is usually contracted through bad breast-milk, and 2) it is careless exposure or improper movements on the part of the mother which renders her milk dangerous to the breast feeding child and puts even older or non-breast-fed children at risk of disease. Almost all women, young and old, accepted some form of mother-blaming explanation for the occurrence of disease in a child.

4. THE MATLAB ALRI CONTROL PROJECT

4. 1. The intervention

The ALRI Control services were introduced after training of all programme health workers in detection, diagnosis, and

management of pneumonia cases. Mothers in the service area were given information about how to recognize pneumonia and how to obtain the newly available treatment.

A pneumonia ward was established in the Matlab ICDDR,B hospital where nasal oxygen, a broader range of antibiotics, intravenous fluid, and 24-hour monitoring were made available. This facility formed the endpoint of a functional chain of referral from the CHW at the village level, to the paramedics at the subcentre clinics, to the medical officers based in Matlab for evaluation and management of complicated or severe cases.

The main thrust of the ALRI project was to improve the timeliness of pneumonia detection, allowing evaluation and management at an earlier stage in the course of illness, and preventing the progression to severe and/or fatal disease. Involvement of families and health workers at community level was crucial to the implementation of this scheme.

Detection by CHWs of children with pneumonia was both **active**, during pre-scheduled household visits, and **passive**, when concerned family members brought children for assessment. Simple diagnostic criteria were used to enable health workers to identify children requiring treatment.

Community diagnosis was based on respiratory rate, and presence or absence of chest indrawing or other signs of severe disease. Health workers were provided with sand clocks and trained to use this simple technology for timing respiration (those who had appropriate watches were trained to use their watches, Figure 3).

Children with only cough and/or low-grade fever were identified as having **mild ALRI**, not pneumonia. Children defined as having **moderate pneumonia** were those with a respiratory rate greater than 50 breaths per minute, with no chest retractions, and no signs of severe disease.

Severe pneumonia was diagnosed in children with chest retractions or other signs of severe disease with respiratory rate greater than 50 breaths per minute. All children aged less than one month with any signs or symptoms of pneumonia were treated as severe on the basis of age.

Other signs of severe and/or complicated disease requiring referral included seizures during the episode, inability to suck or drink, extreme lethargy, very high fever (greater than 39 degrees Celsius), cough for more than 30 days, previous treatment for pneumonia, recent history of measles, wheeze, severe dehydration, and mid-upper-arm circumference less than 110 millimetres.

All children diagnosed with severe disease were referred to Matlab for evaluation and care. Management of moderate pneumonia during the first two years of the project differed within the treatment area which was split into two geographic subareas.

Fig 3: This training poster used in the Matlab MCH-FP Project demonstrates the respiratory rate count, a simple way to assess the severity of acute respiratory infections in children

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This distinction was designed to allow evaluation of home-based antibiotic therapy with penicillin injections compared to referral to a subcentre clinic for outpatient treatment with oral ampicillin syrup. The rationales for use of penicillin injections included the low cost, and the fact that it allowed daily contact by the CHW, insuring compliance.

Due to the experience of CHWs in giving EPI injections and injectable contraceptives, little additional training was required for the use of injections. In mild ALRI, the mother was advised to give supportive care and instructed to return if the child showed signs of worsening disease.

4. 2. Pneumonia mortality and programme impact

The mortality impact of the pre-existing MCH-FP interventions and the subsequent ALRI Control Project was evaluated by comparing the ALRI-specific mortality rates between the MCH-FP area and the comparison area during the two time periods.

Mortality and cause of death statistics were obtained through the pre-existing, ongoing Demographic Surveillance System (DSS). The DSS covers a population of approximately 200,000 including both the MCH-FP area and the adjacent comparison area, where the main services available are provided by either the government or private village practitioners. Verbal autopsy methods were used to identify causes of death in both areas as described in Chapter Five.

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4. 3. Overall programme impact

During the two years prior to initiation of targeted ALRI control (1986-87), the ALRI-specific mortality rate for all children aged less than five years was 28 per cent lower in the MCH-FP area than in the comparison area ($p<0.01$, Table 1, facing page). Within the programme area, the ALRI-specific death rate decreased by another 32 per cent after targeted ALRI control was implemented ($p=0.003$). In contrast, it decreased by six per cent in the comparison area (NS). The difference in reduction of ALRI mortality was found to be significant when comparing the risk of dying from ALRI in the two areas between the two phases (Chi-square for heterogeneity: 4.1, $p<0.05$).

The ALRI-specific mortality rate among under-five-year-olds was 48 per cent lower in the intervention than in the comparison area ($p<0.001$). This difference was responsible for one third of the 30 per cent lower overall mortality among under-five-years-olds in the intervention than in the comparison area (21.1 vs 30.7 per 1000, Table 2, overleaf).

Mortality impact varied by age group. In children aged 1 to 4 years, the ALRI-specific death rate in the intervention area was half of that in the comparison area before the ALRI intervention. Although it was again halved after the project was initiated, the reductions of ALRI-specific death rates in the two areas were not significantly different between the two phases (Chi-square for heterogeneity = 0.6, Table 1).

Among infants aged 1 to 11 months (post-neonates), the ALRI-specific mortality rate was not significantly lower in the intervention than the comparison area before the ALRI project, but it was 30 per cent lower in the project area afterwards ($p<0.05$. (Table 1, facing page). The difference in reduction between the two areas was of borderline statistical significance (Chi-square for heterogeneity = 3.4, $p=0.06$).

Death rates from causes other than ALRI and from all causes are shown in Table 2, overleaf). The former were *lower in the intervention area than in the comparison area* among all children who died under five years and children who died at one to four years, but not among those who died at age one to eleven months.

In both areas and in all age groups, death rates from causes other than ALRI *decreased* during the second phase of the programme, ruling out a "replacement" phenomenon in the assignment of cause of death during the second phase.

None of the differences in reduction of non-ALRI mortality or overall mortality was found to be significant between periods after stratifying by area.

4. 4. Home treatment *vs.* referral

Mortality rates within the MCH-FP area did not differ when comparing the population that received home treatment to that where all cases were referred for care. Comparisons of indicators of socio-economic status in the two populations within the MCH-FP area revealed no major differences in household area and levels of maternal education. There was also no significant difference in mean knowledge about pneumonia between the groups of CHWs serving the two areas. Sixty-two per cent of all confirmed cases were detected by passive surveillance; a significantly higher proportion of these episodes were in the

TABLE 1

ALRI specific mortality during the two phases of the Matlab ALRI control programme, 1986-89.

	Comparison area		Intervention area		%difference in rates between the areas
	No. of ALRI deaths	Rate*	No. of ALRI deaths	Rate*	
All under 5-year olds					
1986-87	210/32 237	6.5	136/29 011	4.7	-28;p<0.01
1988-89	207/33 679	6.1 (-6;NS)#	96/30 350	3.2 (-32;p<0.01)	-48;p<0.001
Chi-square for heterogeneity 4.1, p=0.04					
Children aged 1-4 years					
1986-87	61/24 560	2.5	27/22 331	1.2	-52;p<0.01
1988-89	42/25 701	1.6 (-36;p<0.05)	14/23 700	0.6 (-50;p<0.05)	-63;p<0.001
Chi-square for heterogeneity 0.6, NS					
Infants aged 1-11 months (post-neonates)					
1986-87	108/6979	15.5	79/6057	13.0	-16;NS
1988-89	116/7238	16.0 (+3;NS)	56/6136	9.1 (-30;p<0.05)	-43;p<0.001
Chi-square for heterogeneity 3.4, p=0.06					

* per 1000 child-years of exposure.

Figures in parentheses are the percentage change in mortality rates between the two periods; NS = not significant.

From : Fauveau *et al*, 1992.

CONTINUED...
Acute Respiratory Infections

home treatment area. Significantly higher attack rates occurred in the referral area, reflecting a higher rate of repeat disease. Incidence rates were not significantly different between areas. Data on disease onset and duration were not adequate for assessing programme impact on this outcome.

Among children with pneumonia, 67 per cent received treatment. All treatment rates were significantly higher for pneumonia episodes in the home treatment area than in the referral area. Mortality among treated cases was rare.

Episodes detected only through the mother's history represent 22 per cent of all pneumonia cases recorded. A higher percentage of older children and episodes of moderate severity were detected by history only, that is, those cases not observed to be acute by health workers were less likely to be severe. These results complement findings from the qualitative studies of community perceptions of ALRI-related symptoms and signs.

4. 5. Discussion

These findings illustrate the threat to child survival posed by

TABLE 2

Mortality rates (per 1000 child-years of exposure) from non-ALRI causes and from all causes during the two phases of the Matlab ALRI control programme, 1986-89*

	Comparison area		Intervention area	
	Non ALRI causes	ALL causes	Non ALRI causes	ALL causes
All under 5-year olds				
1986-87	29.0	35.5	22.5	27.2
1988-89	24.5 (-15)#	30.7 (-14)	17.9 (-21)	21.1 (-23)
Children aged 1-4 years				
1986-87	15.1	17.6	9.9	11.1
1988-89	11.0 (-27)	12.6 (-28)	6.2 (-37)	6.8 (-38)
Infants aged 1-11 months (post-neonates)				
1986-87	27.5	43.0	27.2	40.3
1988-89	25.2 (-9)	41.2 (-4)	24.9 (-9)	34.1 (-15)

* Chi-square tests for heterogeneity for the comparison between non-ALRI mortality rates in the intervention and comparison areas were not significant # Figures in parentheses are the percentage change in mortality rates between the two periods.

From : Fauveau *et al*, 1992.

CONTINUED...

pneumonia in rural Bangladesh, and document the effectiveness of community-based case management in reducing pneumonia-specific mortality in children aged less than five years.

A comparison of the effects of home treatment and referral revealed no differences in mortality impact or disease incidence, but did demonstrate significant contrasts in the occurrence of repeat disease and health-care-seeking behaviour. Higher treatment rates were achieved in the area where home-based therapy by community health workers was available.

In addition, families were more likely to seek care from the CHW in the areas where she was able to provide antibiotic treatment at home. This quantitative finding is consistent with qualitative results documenting the many difficulties women face when they are advised to take their child outside the home for care.

Though attack rates were higher in the referral area, the incidence and pneumonia-specific mortality were not significantly different. This indicates that the combination of improved referral care, trained health care workers, and an informed community, can significantly reduce infant mortality associated with pneumonia.

However, the importance of providing home treatment would be greater in settings where infrastructure and referral services are less developed and/or where families are less willing or able to travel a long distance for care. Comparisons of episode distribution according to the method of case detection raise questions about the accuracy of mothers' diagnoses when symptoms are mild. These findings were consistent with the qualitative results indicating that mothers recognize signs of severe pneumonia (chest retractions) more consistently than those of moderate disease (rapid breathing).

Children in the referral area were less likely to receive appropriate treatment when sick with pneumonia. They may have subsequently experienced more unresolved infections or incomplete treatment of disease. Such events could lead to the higher incidence of repeat pneumonia cases observed, but further analysis is needed to delineate other potential risk factors for repeat disease. Admission rates were undoubtedly lowered by provision of community-based care, at home and in clinics.

The cost of drugs for home therapy was approximately $2.00 (US) for a five-day course of procaine penicillin, including syringes. A course of ampicillin syrup, used for outpatient therapy of moderate cases, cost an average of $1.50 (US) per episode.

The cost of caring for admitted cases was considerably higher than that of outpatient care. The costs of programme operations were minimized by implementing the pneumonia control intervention within the infrastructure of the pre-existing MCH-FP programme.

In mid-1989, the Government of Bangladesh (GOB) presented the National ARI Programme plan (Government of Bangladesh, 1989). These guidelines proposed the use of oral paediatric co-trimoxazole (sulphamethoxazole/ trimethoprim) tablets for home-based treatment of mild/moderate pneumonia by field health workers.

Equally important, referral facilities are to be upgraded and all levels of staff are to be trained in detection, diagnosis, and management of pneumonia.

Provision of antibiotic tablets, as opposed to daily injections, maintains the locus of responsibility within the household, while enabling access to essential treatment which might otherwise be exceedingly difficult to obtain. The choice of oral tablets was based on issues of feasibility and has yet to be tested in Bangladesh.

Because of the need to standardise management nationally, and in an effort to study the effectiveness of these recommendations, the Matlab ALRI project was extended, in January 1990, to use these guidelines in the blocks serving as a referral area in the first phase. ■

CONTINUED...
Acute Respiratory Infections

CHAPTER 10

Acute Respiratory Infections in Matlab : Epidemiology, Community Perceptions and Control Strategies

M. Kathryn Stewart, Vincent Fauveau, Barbara Parker, Jyotsnamoy Chakraborty & Shameem Akhter Khan

Lessons learned and recommendations...

The two main lessons from the Matlab programme are that 1) ALRI is a disease mostly affecting young infants, and 2) under controlled conditions, it is possible to decrease mortality through community-based case management. Although the exact role of home treatment of moderate pneumonia is still unclear, a well-coordinated combination of decentralized services, both at home and in clinics, in addition to inpatient care of severe cases, is needed.

The success of a ALRI control programme depends on :

1) *the provision of training and supervision to all cadres of health care providers including those posted in the community (CHWs), at the health centre (paramedics), clinic (nurses), and in the referral hospital (medical officers);*

2) *the provision of regular reliable supplies of antibiotics for those responsible for treatment, in addition to oxygen and oxygen-delivery equipment at the referral site;*

3) *integration from the beginning of programmes to communicate with families about how to recognize both moderate and severe pneumonia and what to do when these signs and symptoms occur, which is particularly pertinent regarding the recognition of rapid breathing, an early sign of ALRI; (Since family members other than the child s mother, particularly the mother-in-law and husband, often play a dominant role in making decisions about seeking outside care, these key players must also be targeted for educational input.)*

4) *the recognition that local beliefs, which blame the mother s improper behaviour for the illness of the child, can delay care seeking since a mother may be reluctant to call attention to a condition in her child, which is thought to indicate misbehaviour or neglect on her part; (Therefore, these beliefs must be challenged by health care providers.)*

5) *the careful monitoring and evaluation of the programme after implementation. (This is valid for pilot projects as well as for the National ARI Programme.)*

1) *Existing data should be more fully exploited to:*

   * *identify other potential risk factors for repeat disease;*

   * *further define predictors of treatment and service use;*

   * *study the importance of vitamin A in ALRI.*

2) *An intensive cohort study has been proposed to look more at the possible risk factors for development of ALRI, including low birth weight (Victora, et al., 1988; Datta, et al., 1987), nutritional status, and indoor air pollution (Morris, 1990).*

3) *Observational studies are needed to better understand household practices affecting health as well as the dynamics of health care seeking behaviour.*

4) *It is estimated that a large portion of severe pneumonia cases in young children are due to infection with Streptococcus pneumoniae (Institute of Medicine, 1986). However, current S. pneumoniae vaccines are not immunogenic in children aged less than two years, that is, the period during which most ALRI deaths occur. Maternal immunization with the 23-valent S. pneumoniae polysaccharide vaccine is one proposed solution to this dilemma. This approach would potentially result in passive protection of infants in a manner similar to that of maternal immunization with tetanus toxoid.*

   Research is needed to document the efficacy of immunizing pregnant women in reducing infant morbidity and mortality. Matlab might potentially serve as a field site for activities in this vital area of research (Steinhoff, 1991).

5) *Other vaccine research now underway elsewhere is centered on the development of conjugated vaccines able to provide protection in the first year of life. However, the success of such efforts is largely dependent on a knowledge of the prevalence of specific bacterial serotypes within the population to be immunized. While hospital-based data on aetiologies of ALRI is available for Bangladesh, no community-based studies have been conducted to date to obtain this information.*

6) *Such studies would also facilitate investigations into antibiotic sensitivity. Information regarding the risk of antibiotic resistance is essential to assure the success of the GOB plan to dispense co-trimoxazole to village workers for home-based treatment of pneumonia.*

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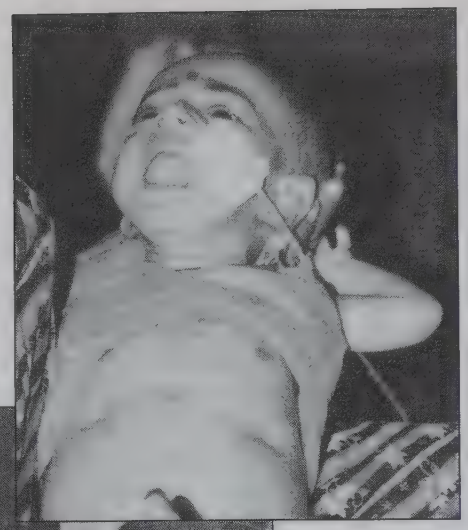


Respiratory problems, particularly in infants, can bring about sudden death unless adequate medical facilities are provided. This baby is not a happy baby – but it is alive and will, most likely, be smiling again soon.

CHAPTER 11

Measles in Matlab

Vincent Fauveau

Affecting about 70 million children worldwide and responsible for up to two million deaths every year in the 1980s, *measles is the single most important vaccine-preventable cause of morbidity and mortality among children in developing countries* (Assad, 1983; Walsh & Warren, 1979; Henderson, *et al.*, 1988).

For many years, measles has been recognized as a major public health problem in Africa (Morley, *et al.*, 1963; Loening & Coovadia, 1983). In contrast, less concern has been expressed about its contribution to child mortality in Asia, particularly in the Indian sub-continent (Pereira, *et al.*, 1972).

Two recent findings, however, have triggered a renewed interest in the field of measles control: one, the discovery and successful pre-testing of the new generation of measles vaccines, which permit children to be immunized at an earlier age (Markowitz, *et al.*, 1987; Whittle, *et al.*, 1984; Aaby, *et al.*, 1988; Tidjani, *et al.*, 1989; Whittle, 1988a; World Health Organization, 1989b).

The other is the impressive reduction in mortality resulting from measles immunization in Bangladesh (Clemens, *et al.*, 1988; Koenig, *et al.*, 1990; Koenig, *et al.*, 1991).

In this paper, the current knowledge on the epidemiology of measles in rural Bangladesh is reviewed, knowledge which has been almost exclusively acquired in Matlab over the past 15 years through large community-based measles surveillance systems.

First, morbidity studies are reviewed, focusing on age distribution and transmission, followed by mortality studies, focusing on post-measles complications. Then what has been learned as regards immunization against measles is addressed, focusing on operational issues, impact on mortality, and possible areas for further studies.

PART II

CONTINUED...
Measles in Matlab

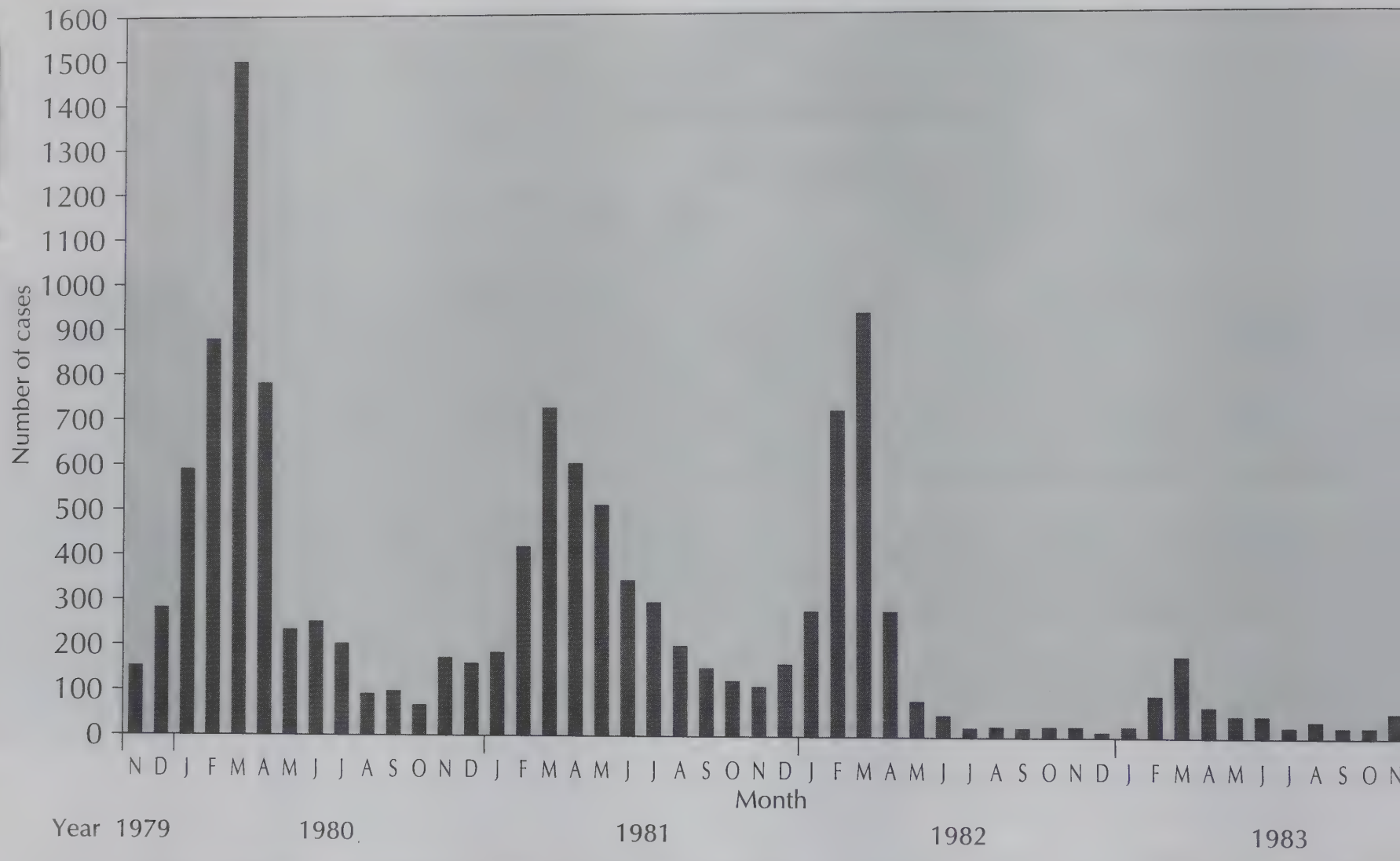


Fig 1 : Number of measles cases by month (1979-83) unvaccinated population, Matlab, Bangladesh

Source : D'Souza et al. Mortality and Morbidity : the Matlab Experience. IORC Technical Study 56c, Ottawa 1988

1. MEASLES-RELATED MORBIDITY : STUDIES BASED ON MEASLES SURVEILLANCE SYSTEM

1.1. The first study of measles in Matlab was undertaken as part of a broader disease surveillance system which ran from August 1975 to July 1976 (Koster, *et al.* 1981).

The objective of this prospective weekly household surveillance was to examine the relationship between diarrhoea, measles, malnutrition and mortality in children aged less than 10 years. Serological support for the diagnosis of measles was obtained during an epidemic in one village, where 160 children and 110 age-matched controls were bled, using the fingerstick technique, two weeks after the last case of measles had been reported in the village.

In one year, a total of 896 cases were recorded among children aged less than of 10 years, seven of these (0.8 per cent) being infants aged less than six months. Ninety-eight per cent of the children reported as having clinical measles showed serological evidence of prior measles.

The study showed that in fatal cases prolonged diarrhoea was the most common complication of measles, and that in surviving children aged less than four years the weight loss resulting from measles was not recovered.

This was the first demonstration of the synergistic interaction between measles and prolonged diarrhoea, in which the combined effect on malnutrition was greater than the sum of the effects of each infection.

1.2 The second measles surveillance system in Matlab was set up in November 1979 by D'Souza, *et al.* (1988) and covered all villages of the DSS area. Each of the 110 female community health workers, who visited each household twice a month, asked about measles cases that had occurred since their last visit.

All cases were recorded and reported to supervisors and medics who occasionally paid home-visits to confirm the diagnoses. Clinical supervision was not a priority, and it declined both in quality and quantity over time.

Nevertheless, the seasonal distribution of reported cases, with annual peaks in the month of March, argues very strongly in favour of diagnoses being reasonably reliable (Figure 1, facing page). . Indeed there are no other eruptive diseases that follow a similar pattern of winter peaks and can be confused with measles.

The age distribution of the 3,698 measles cases reported in children aged less than 10 years in the comparison area during 1980-81 has been analyzed by Fauveau, *et al.* (1991).

To optimize consistency, the analysis was restricted to the first two years of this surveillance and to cases with a reported duration of rash of between 4 and 12 days. There was a clear peak of incidence at the age of 5 months, followed by a steady decline as age increased.

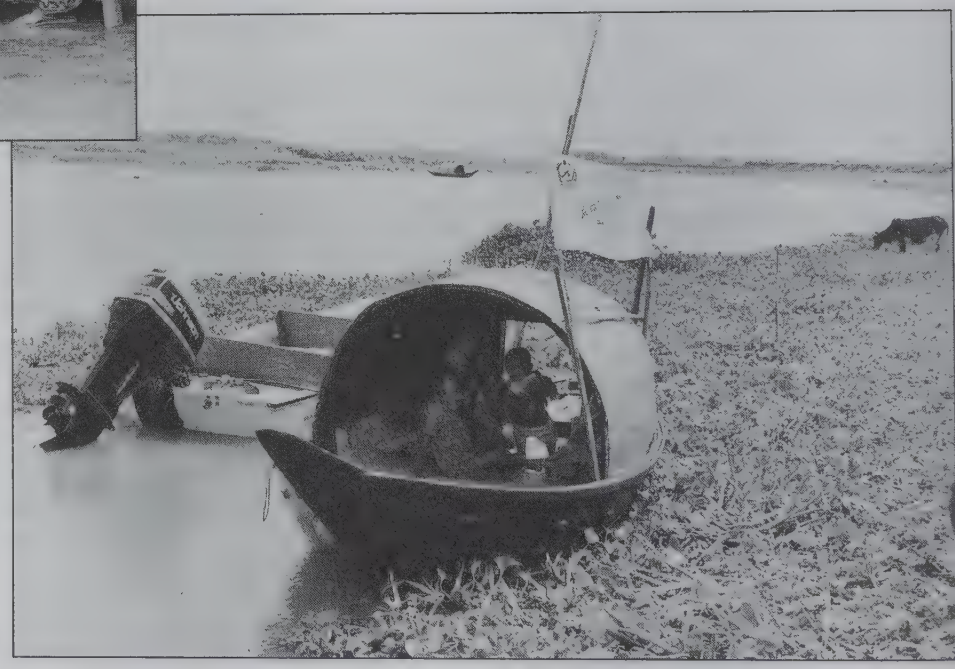
Of all 2,434 cases reported in children aged less than five years, thirteen per cent occurred below the age of six months, and 21 per cent below the age of nine months. Four per cent, however, were reported to occur below the age of three months, but the validity of these cases is not well established.

CONTINUED...
Measles in Matlab

Given that a substantial amount of clinical measles was reported to occur in children aged over ten years and in young women, it is conceivable that some unimmunized mothers might not have transferred passive immunity to their child at birth, and therefore these infants might be infected at ages younger than six months. There is no biological evidence for this hypothesis, however, since no serologies were performed on infants of aged than six months.

The case-fatality ratio (CFR) for measles is defined as the percentage of all reported cases that died within 6 weeks of the

Although most vaccines are delivered to the doorstep in the Matlab Project, mothers occasionally gather at the sub-centre for campaign-type immunisation programmes.



The Measles Surveillance System requires quick reporting of detected cases to the Matlab centre, so that a health assistant or a doctor can come and visit the house, confirm the diagnosis, treat if necessary, and follow the case.

onset of the rash. It appears from Table 1, below, that the severity of measles is inversely related to the age of onset.

The CFRs for measles reported in 1980-81 have been calculated for two durations of follow-up, 6 weeks and 12 weeks after the onset of the rash. The inverse relationship is similar in both cases.

The average CFR for children aged less than 5 years was 1.7 per cent for a follow-up of six weeks and 2.0 per cent for a follow-up of 12 weeks.

Using the same measles surveillance system, Bhuiya, *et al.* (1987) found a 6-week measles-related case-fatality rate of 1.8 per cent: 69 of the 3,458 children aged less than 5 years reported to have measles died of measles-related causes (diarrhoea, dysentery and respiratory problems) within 45 days of the onset of the rash.

In a univariate analysis, female gender, low economic status, and no maternal education were found to be significantly associated with a higher case-fatality. A multivariate logistic regression

TABLE 1

Measles case fatality rates by age (calculated for two different assumptions for length of follow-up for delayed measles complications)

AGE GROUP (in months)	No.Children with measles	6-Weeks follow-up		12-Weeks follow-up	
		Deaths	CFR	Deaths	CFR
Matlab Comparison area, not vaccinated, 1980-81					
6-12	425	11	2.59	13	3.06
13-24	564	13	2.30	15	2.66
25-36	526	9	1.71	10	1.90
37-48	529	7	1.32	8	1.51
49-60	386	1	0.26	2	0.52
61-120	1084	3	0.28	4	0.37
Matlab Treatment area, not vaccinated, 1975-76 (from Koster, *et al.* , 1981).					
1-23	203	9	4.44		
24-47	307	13	4.24		
48-71	193	8	4.15		
72-120	193	3	1.55		
total	896	33	3.68		

CONTINUED...
Measles in Matlab

confirmed the same factors and revealed a significantly greater case-fatality among secondary cases than among primary cases*. Age was not found to be a significant factor in this analysis.

In a limited follow-up study, a cohort of 77 children aged less than 2 years who contracted measles during an outbreak in March-April 1980 was compared with a cohort of controls who had not contracted measles during the fifth and sixth months after the onset of the rash among the cases (Shahid, *et al.*, 1983).

Only one of the 77 cases was reported to have died during the follow-up period. Significantly greater incidences of respiratory problems, mucoid or bloody diarrhoea, and conjunctival dryness (a proxy for vitamin A deficiency) were found among children who had had measles than among controls. There were no differences as regards nutritional changes between cases and controls.

1.3. A third measles surveillance system was established in the Matlab comparison area in December 1989. One of the objectives was to monitor the incidence of measles in relation to the nationwide Expanded Programme of Immunization (EPI) that had started in 1986. The emphasis was on validity, with medical confirmation of as many cases as possible.

Female community health workers were again responsible for the detection of cases during their fortnightly home visits. A system allowing for quick transfer of information to the central office in Matlab was set up with messengers and boatmen, enabling the medical officers or medical assistants to visit patients' homes within a few days of the onset of the rash, and possibly while the rash was still present.

CONTINUED...
Measles in Matlab

Since it was not possible to visit all patients, guidelines were established to give priority to cases reported in very young infants (aged less than 6 months), and to primary cases (that is the first case detected in a given *bari* or cluster of households). Medics responsible for visiting patients were given drugs and guidelines on whether to treat or refer severely ill patients.

A further objective of the project was to establish the age distribution of measles cases, particularly among infants of aged than 9 months, and to set the scene for a measles vaccine trial involving immunization of infants between 4 and 6 months of age with one of the newly-developed vaccine strains.

The results of the first 13 months of this third measles surveillance are summarized in Table 2, facing page.

Figures 2 and 3 (pages 212, 213) show details of age distribution patterns.

These patterns of age distribution are very similar to those of the previous measles surveillance 10 years earlier, with 4 per cent of all cases in children aged less than 5 years occurring below 3 months, 12 per cent below 6 months and 22 per cent below 9 months of age.

Over 13 per cent of all cases reported before the age of 10 years were medically confirmed through a home or clinic visit (Figure 3). The peak age at onset was 6 months both for confirmed cases and for all cases reported.

There was a secondary peak at 50 months, and another at 26 months, the latter being of less magnitude and only among females. The reasons for the secondary peak at 50 months and

1. Within a village, households are displayed around common courtyards or baris and each bari is identified by a name and a code number. Linkage between family number and bari number allows the determination of the primary or secondary nature of the case. A primary case is a first case in a given bari, a secondary case is a case appearing more than one week after the onset of the rash of the primary case in the same bari, and a tertiary case is a case appearing more than one week after. A case appearing more than one month after the rash onset of the last case reported in a given bari is treated as a new primary case.

the sex-linked accessory peak at 26 months are yet to be clarified. One explanation might relate to the transmission of the disease, that is to whether cases were primary or secondary. Another explanation might lie in socio-cultural influences.

2. MEASLES-RELATED MORTALITY: STUDIES BASED ON THE ANALYSIS OF CAUSES OF DEATH

2.1. Proportional and cause-specific death rates

Measles has been reported to be a leading cause of child death in many places in rural Bangladesh. Table 3 (Page 214) summarizes the findings of several studies that looked at measles as a cause of post-neonatal and/or child deaths. The findings of the 1975-76 surveillance reported by Koster, *et al.* (1981) are not included in this table because the age groupings did not correspond.

In that study, measles-specific mortality rates were 7.9 and 3.7 per 1,000 children aged 1-47 months and 48-120 months, respectively.

The findings reported in these studies, however, were all based on lay reporting of symptoms preceding death, according to the method of "verbal autopsy". There are several reasons to believe that these figures significantly under-estimate the importance of measles in early childhood mortality.

First, the conservative definition employed to classify measles-related deaths (within 6 weeks of the onset of measles) may have excluded a number of deaths due to delayed mortality from measles.

A second and related point is that the cause-of-death data may have overlooked the potentially substantial indirect effect of measles on mortality through its relationship to other causes of death, such as diarrhoea and acute respiratory infection.

Continued on P. 215

TABLE 2

Age distribution of reported measles cases under the age of 10 years, Matlab Measles Surveillance System, December 1989-December 1990.

Categories	All reported cases	Confirmed cases	Males	Females
No. cases:	2776	372	1420	1356
Peak age (months)	6	6	6	6
Secondary peak (months)	50	50	50	50
Accessory peak (months)	26	26	..	26
Mean (SD) age at onset:	34.8(25)	35.8(24)	34.6(25)	35.1(25)
Per cent cases in children aged less than 5 years:				
3 months	4	1	4	4
6 months	12	9	13	12
9 months	22	20	23	20

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Measles in Matlab

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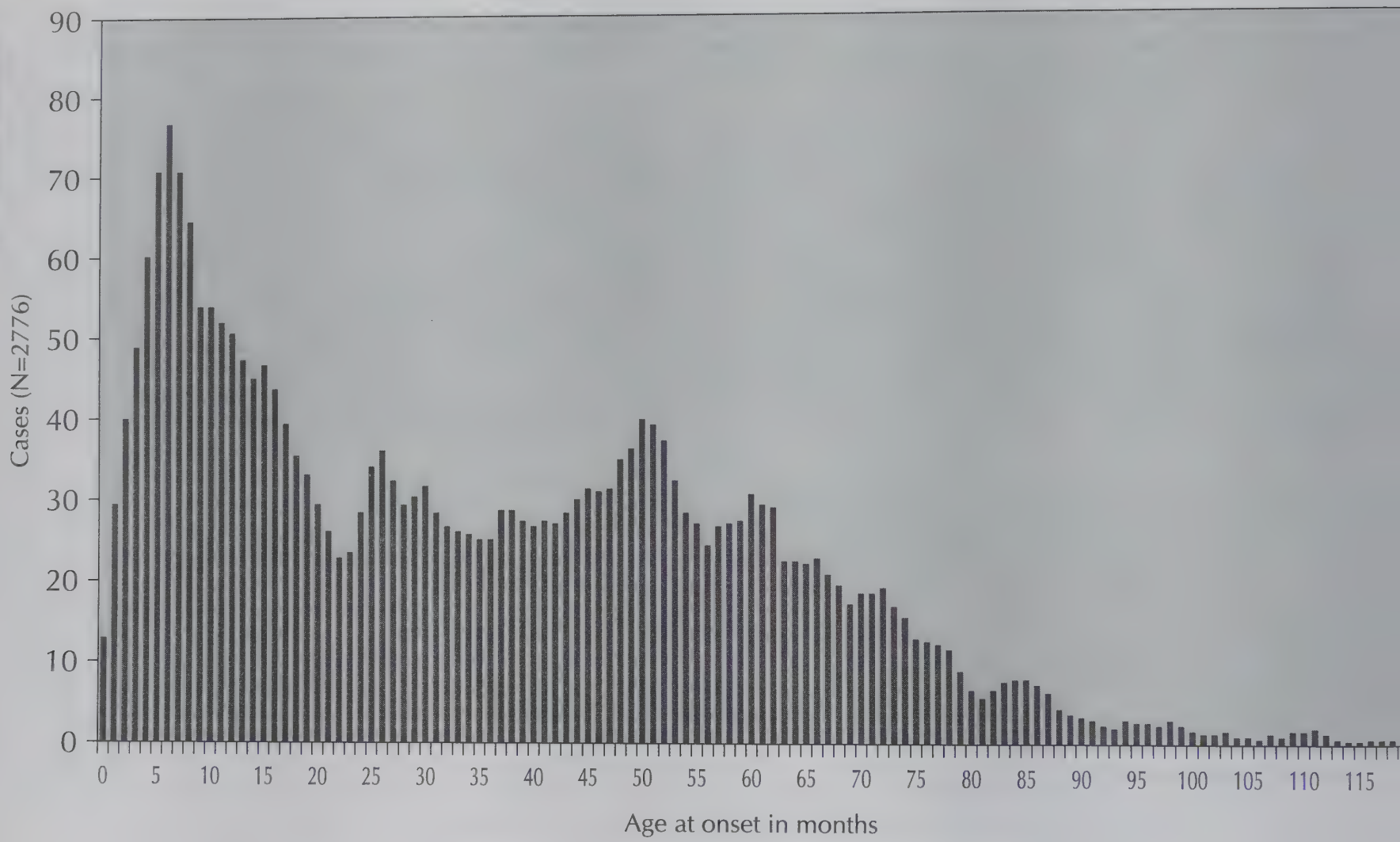

Fig 2 : Age at Onset of Measles, Matlab, 1990
Comparison area, Immunization, 27% of children aged 9-59 months

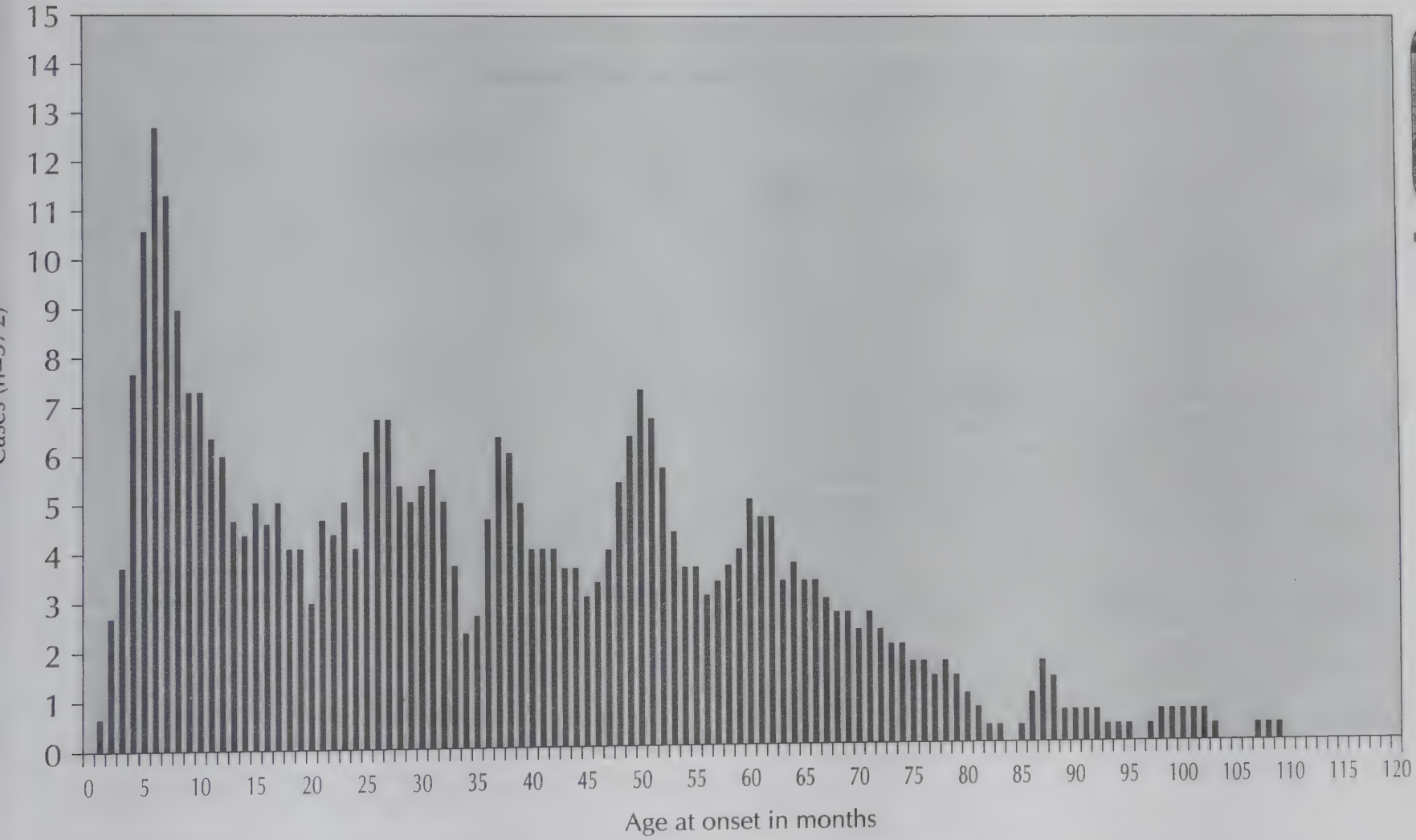

Fig 3 : Age at Onset of Measles, Matlab, 1990
Comparison area, Confirmed Cases only

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Measles in Matlab

TABLE 3

Measles as a cause of death in rural Bangladesh.

Place of study, Years covered, Reference.	Total deaths	Proportion due to measles (per cent)	Measles specific death rate (per 1,000)
CHILD MORTALITY (1-4 YEARS):			
Matlab, 1975-77 (Chen, *et al.*, 1980)	3383	13	4.5
Companigonj, 1975-77 (Chowdhury, *et al.*, 1980)	151	7	n.a.
Matlab Comparison area, 1986-87 (Koenig, *et al.*, 1991)	430	13	2.2
Matlab Comparison area, 1988-89 (Fauveau, 1990, unpub.)	323	15	1.9
Matlab Comparison area, 1990 (Fauveau, 1991, unpub.)	106	17	1.4
POST-NEONATAL MORTALITY (1-11 MONTHS):			
Companigonj, 1975-77 (Chowdhury, *et al.*, 1980)	77	5	n.a.
Teknaf, 1976 (Islam, *et al.*, 1982)	96	6	4.4
Matlab, 1982-83 (Bhatia, 1989)	378	6	2.7
Matlab Comparison area, 1986-87 (Koenig, *et al.*, 1991)	300	3	1.0
Matlab Comparison area, 1988-89 (Fauveau, 1990, unpub.)	296	3	1.1
Matlab Comparison area, 1990 (Fauveau, 1991, unpub.)	109	3	0.9

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Measles in Matlab

Third, the likelihood of under-reporting the initial incidence of measles in cases when the death of a child has been attributed to one of the common complications of measles may be high.

Using the restricted definition of a measles-related death (i.e. death within six weeks of the initial rash), it was found that between 1986 and 1988, 13 of 98 (13 per cent) measles-related deaths in the Matlab comparison area had occurred in infants aged less than nine months (Fauveau, *et al.*, 1991). This is probably a low estimate: The actual proportion might stand between 15 and 20 per cent.

Variations in the classification of measles-related deaths may be partly responsible for the variations in CFRs reported in the studies. Koster, *et al.* (1981) reported a CFR for measles in children under 10 years of 3.7 per cent in 1976, as opposed to 1.5 per cent in 1980-81.

Working from their findings, they extrapolated that approximately 75,000 children aged less than 10 years may die of complicated measles each year in Bangladesh. Another estimate, based on the 1986-87 findings of measles-related mortality in Matlab, indicated approximately 50,000 measles-related deaths among 6-36-month-old children each year in the country (Fauveau, unpublished).

2.2. Trends in measles-related mortality

Figure 4 (overleaf) shows trends in measles mortality from 1975 to 1990 in MCH-FP and comparison areas according to the assessment of cause of death through verbal autopsy (see Ch. 5).

Taking into account the above-mentioned reservations on the likelihood of under-reporting the true role of measles in childhood mortality, it appears that measles-specific mortality rates have started to decline in the comparison area since 1987, in the same way as they have declined in the MCH-FP area since 1982.

2. 3. Measles mortality by age, sex and season

Figures 5 (overleaf) and 6 (page 218) show the age, sex, and seasonal distribution of 98 measles deaths in children aged less than five years during 1986-88 in the Matlab comparison area.

Thirteen per cent of all these deaths occurred among infants aged 4 to 9 months, while the highest reported number of measles-related deaths occurred among children aged 16 to 33 months.

In the whole DSS area, a significantly greater proportion of measles-related deaths involved females than males (58% vs. 42%, $p<0.05$). Almost half of all measles-related deaths occurred during the three dry months of March, April and May.

2. 4. Mortality among primary and secondary cases

Koster (1988) analyzed measles-case fatality among primary and secondary cases in two selected "epidemic" villages from his 1975-76 measles surveillance. He found that CFR among secondary cases was significantly greater than that of primary cases.

The difference was even greater when restricted to children who were aged less than 36 months at the onset of the rash. Comparison of nutritional status among fatal and non-fatal cases showed no differences. These findings corroborate those of Aaby, *et al.* (1984) proposing over-crowding and intensive exposure to measles virus and other pathogens as major determinants of measles-related mortality.

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Measles in Matlab

3. MEASLES VACCINATION IN MATLAB AND ITS IMPACT ON MORTALITY

3. 1. Measles vaccination

Measles vaccination in Matlab started in February 1982, when it was offered to all children from the age of 9 months in Blocks A and C. The vaccine used was the classical Schwarz strain, and the method of delivery was home visits by community health workers. Community health workers keep note of children

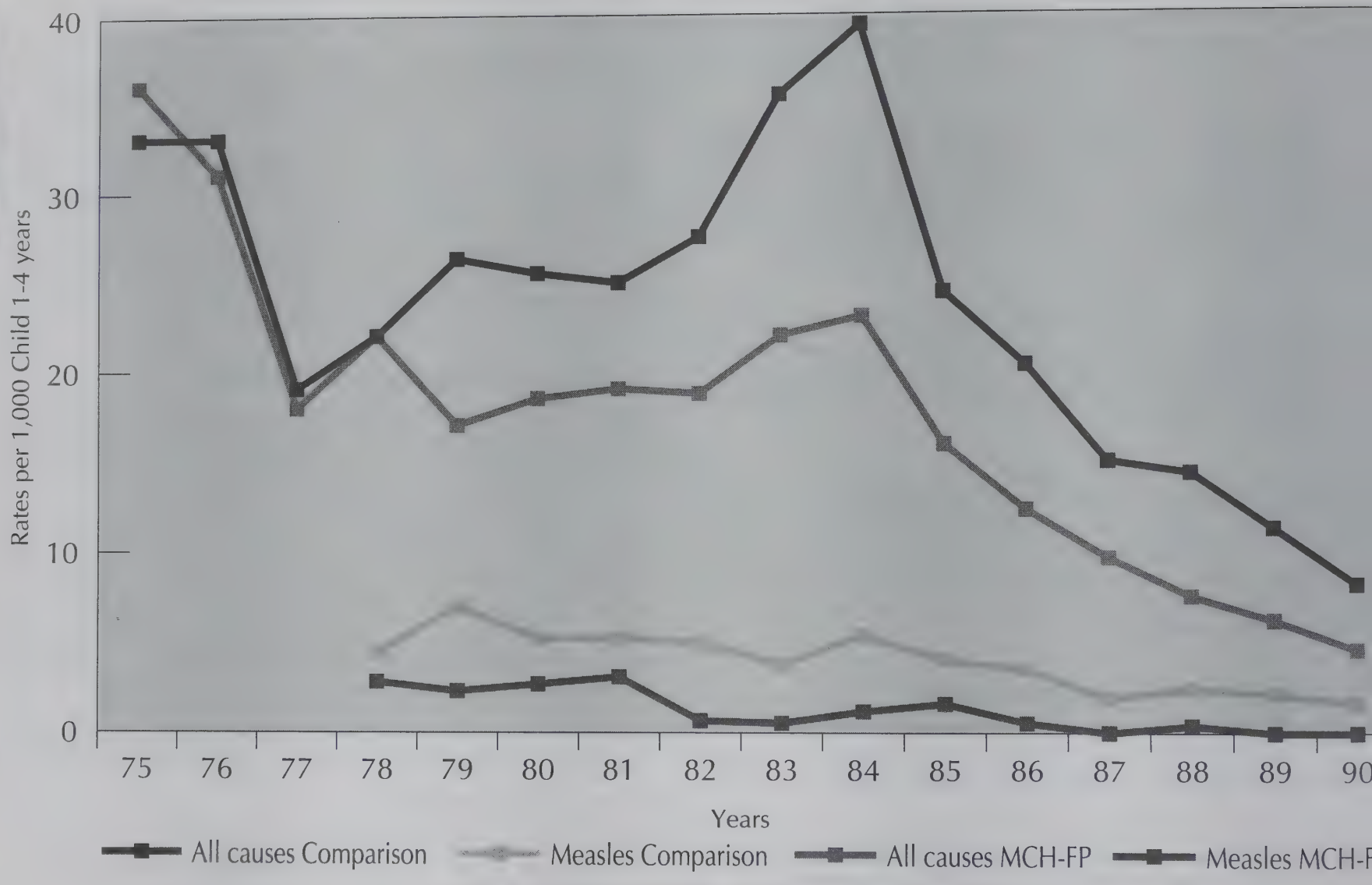

Fig 4 : Child mortality, all causes and measles
Matlab MCH-FP and comparison areas, 1975-90

Note : The peak of mortality in 1983-84 was due to an outbreak of dysentery.

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Measles in Matlab

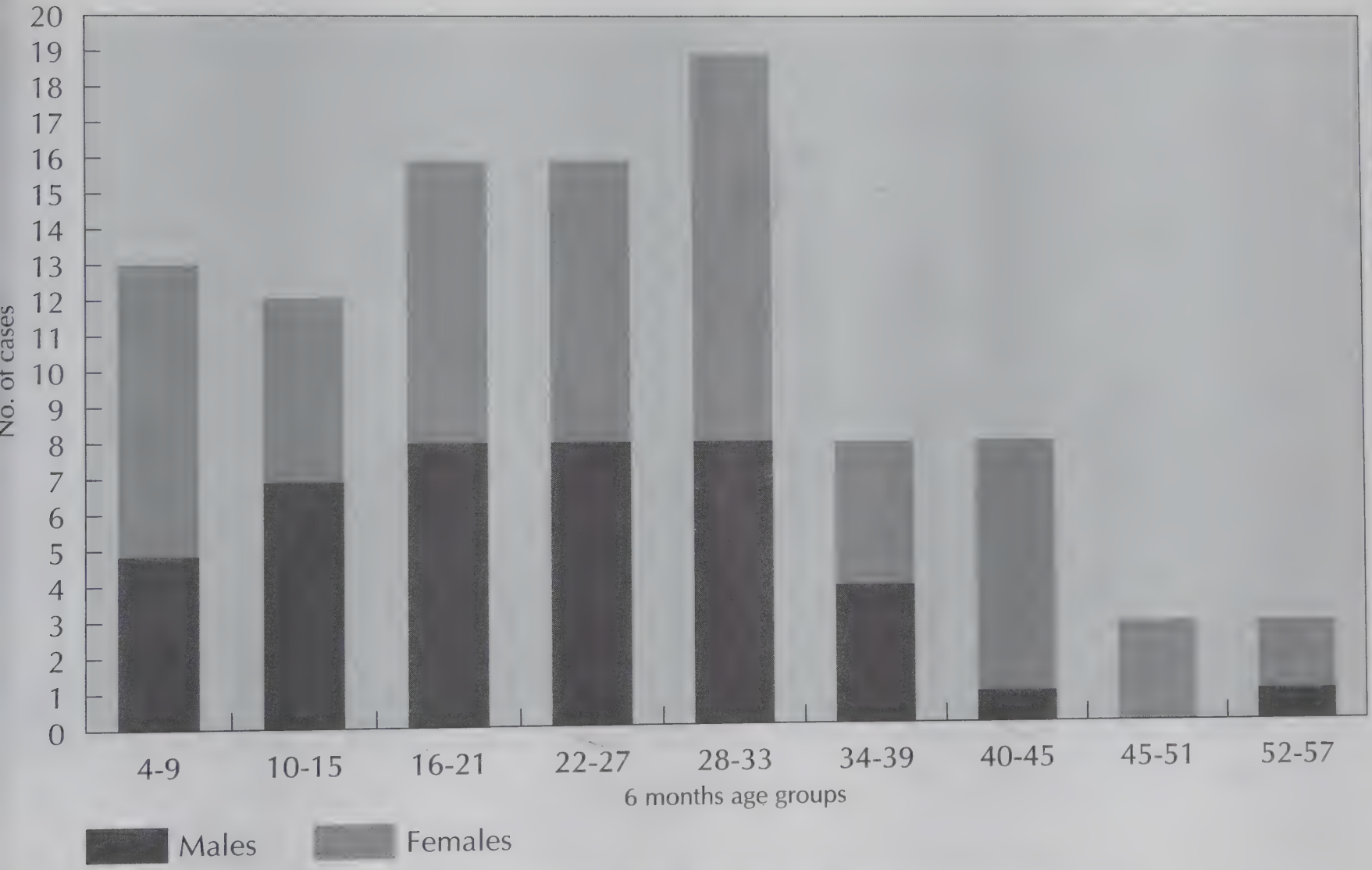

Fig 5 : Measles mortality by age and gender unvaccinated population
MATLAB COMPARISON AREA, 1986-88 (n=98)

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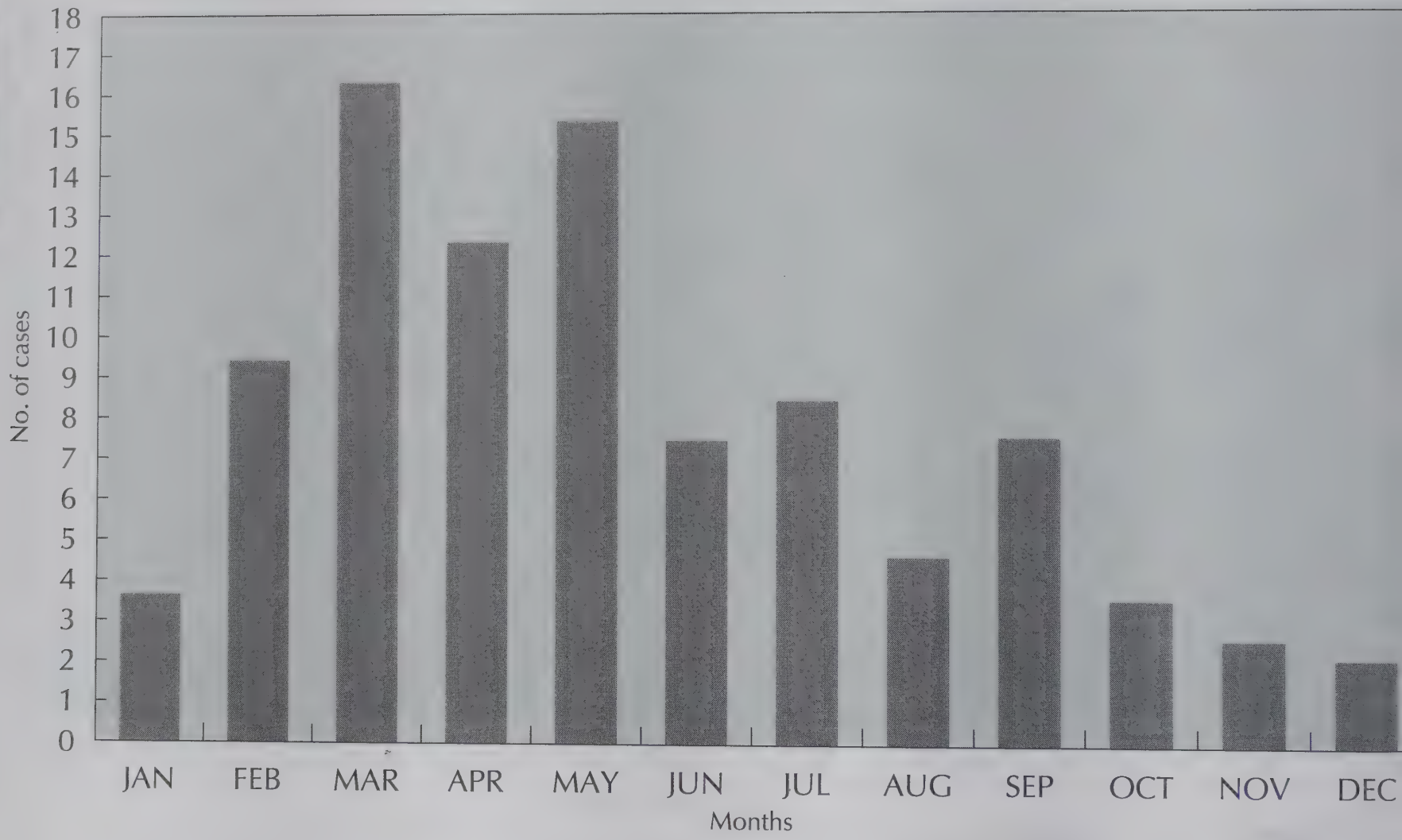

Fig 6 : Seasonality of Measles Mortality
MATLAB COMPARISON AREA, 1985-88

TABLE 4

Sex differentials in measles immunisation coverage among children aged 9 to 59 months, Matlab MCH-FP and comparison areas, 1990 KAP Survey.

	Male			Female			
	Vacc.	total	%	Vacc.	total	%	Z-test
MCH-FP area:	1,111	1,317	84.4	1,056	1,263	83.6	0.46(ns)
Comparison area:	481	1288	37.3	410	1328	30.9	3.45(***)
			(***)				(***)

*** : p<0.001 comparison of percentages within areas and between areas

reaching the age of 9 months in their service record books, and organize a vaccination session as soon as a group of at least five children have been gathered in a *bari*. The cold chain is maintained in the central Matlab clinic and vaccine carriers are delivered by boatmen and foot-messengers on request.

The extension of the measles vaccination programme to the other two Blocks, B and D, did not occur until December 1985. During the first 3 months of the programme, coverage rates increased rapidly in each of these two pairs of Blocks, reaching about 50 per cent of children aged 9 to 59 months.

After this initial phase, coverage rates continued to increase but at a slower pace, reaching over 90 per cent of children aged 9 to 59 months in 1989 (Figure 7, overleaf).

Informal interviews conducted in the community revealed that people have noticed the almost complete disappearance of measles in the MCH-FP area.

Information on measles vaccination (dates, doses) and coverage rates in the MCH-FP area are available from the Record Keeping System (RKS). Coverage rates in the comparison area are based on occasional surveys, the latest of which was carried out in 1990. An analysis of sex-differentials in measles vaccination coverage using data from this 1990 survey showed a significantly higher coverage rate in boys than girls in the comparison area, while no such difference was found in the MCH-FP area (Table 4, above).

One of the reasons for this differential might be the mode of delivery of measles vaccine, the vaccine being delivered to the home in the MCH-FP area and through clinics in the comparison area. There is obviously a greater cost to the family in terms of time and transport to reach the clinic, and since boys are more highly valued than girls in Bangladesh, this might have influenced the decision to bring boys more often than girls to the vaccination centre.

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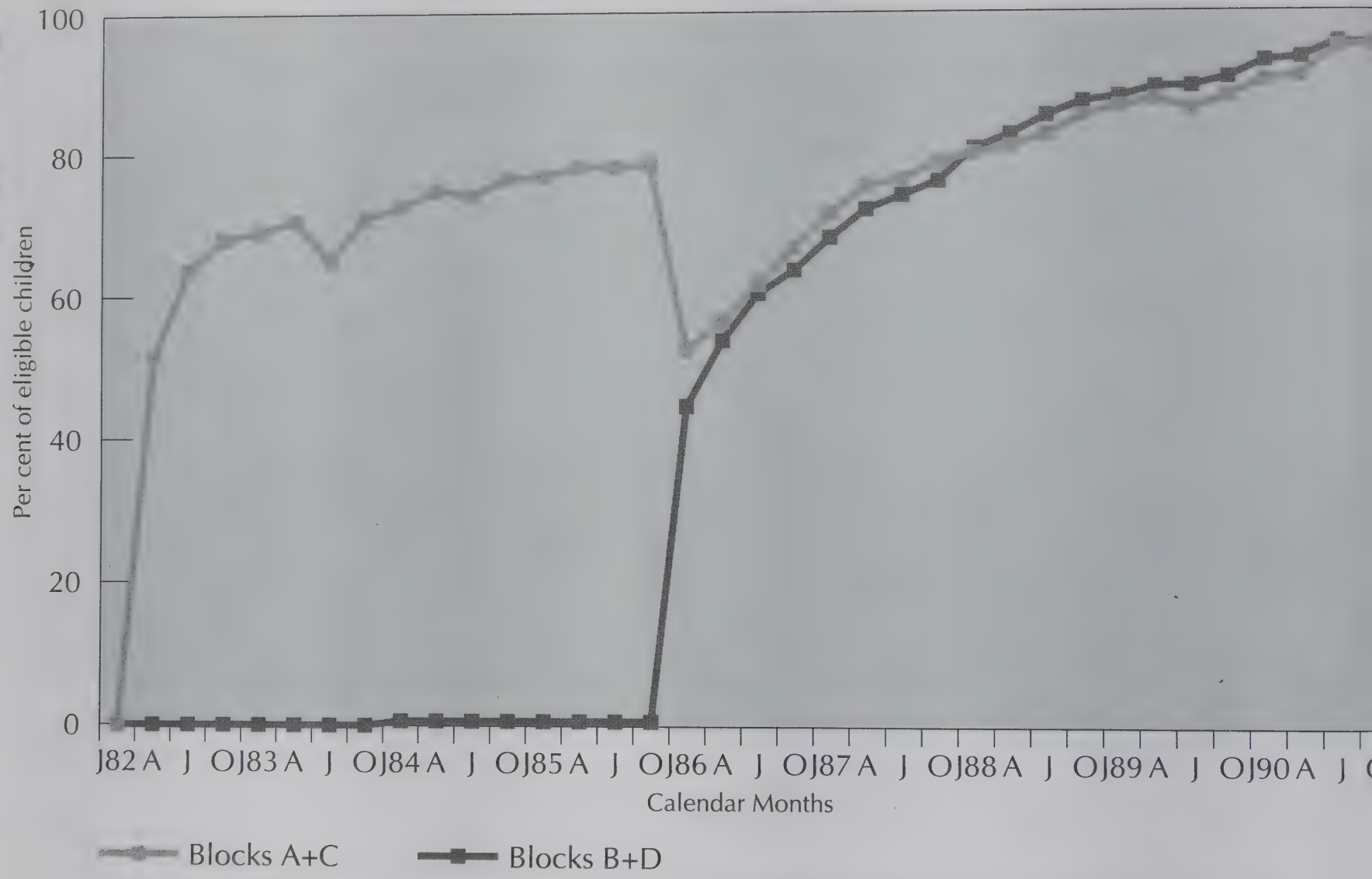
100
80
60
40
20
0
Per cent of eligible children
J82 A J OJ83 A J OJ84 A J OJ85 A J OJ86 A J OJ87 A J OJ88 A J OJ89 A J OJ90 A J
Calendar Months
Blocks A+C
Blocks B+D

Fig 7 : Measles immunization coverage rates (9 months-5 years), Matlab MCH area, 1982-90

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Measles in Matlab

3. 2. The impact of measles vaccination on mortality

An indirect but quite powerful way of estimating the role of measles in childhood mortality is to estimate the reduction in overall mortality rates caused by an effective vaccination programme.

Three different hypotheses are possible:

1) the impact of measles vaccination on mortality is restricted to its impact on measles-related mortality alone;

2) the impact is less than expected because children who might otherwise have died from measles will die from "replacing" diseases; and

3) the impact is greater than expected because measles-related mortality is mainly due to long-term complications (dysentery, persistent diarrhoea, severe malnutrition, respiratory infection) which are prevented by measles vaccination.

Despite controversial findings in Africa (Kasongo, 1981), ***it is now widely recognized, and has been particularly demonstrated in Matlab, that the impact of measles vaccination on child mortality is greater than the expected impact on measles mortality alone***. This multiplication effect is due to an effect on herd immunity and on delayed mortality (Foster, 1984). It is, therefore, appropriate to examine the impact of measles vaccination on overall child mortality. The vaccination schedule of children in the Matlab MCH-FP area between 1982 and 1986 has allowed for two different methods of evaluating the impact. One was a retrospective assessment of the risk of death by a case-control design (Clemens, *et al.*, 1988), the other a longitudinal cohort analysis (Koenig, *et al.*, 1990).

The case control study involved 536 children in the MCH-FP area, who had died between 10 and 60 months of age between April 1982 and December 1984, and 1,072 age-sex-matched controls who had survived until at least the date of death of their matched case. Measles vaccination was associated with a 36-per cent proportionate reduction in overall mortality and a 57-per cent reduction in measles-related mortality. This is equivalent to a protective efficacy of measles vaccination of 36 per cent.

This protective efficacy (more appropriately termed "effectiveness" since it was the effect of a programme) was sustained for at least two years after vaccination, and was greater in children aged over two years than in younger children, ruling out the hypothesis of replacement mortality.

The longitudinal study involved the following-up of mortality among a cohort of 8,135 vaccinated children aged 9 to 60 months and 8,135 age-sex-matched unvaccinated children, observed from March 1982 to October 1985.

Some of these children were, therefore, followed for up to three and a half years (Figure 8, overleaf, borrowed from Koenig, *et al.*, 1990). The risk of dying from any cause in vaccinated children relative to unvaccinated children was 0.54 (0.45-0.65, $p<0.0001$), yielding a protective efficacy of 46 per cent. This protective efficacy was found to be greater during the first year after vaccination than during the subsequent years, in younger than older children, in lower than higher socio-economic strata, and in female than male children.

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Measles in Matlab

3. 3. Perspectives for the future : towards measles vaccination at 5 months of age?

Ultimately, the decision to modify the immunization strategy, away from the use of conventional vaccine strains given at 9 months of age to the adoption of the recently tested strains given at 4 to 6 months of age, will depend on 3 factors:

i) the age distribution of severe cases in the community (Halsey, 1983; Halsey, *et al.*, 1989; World Health Organization, 1988; World Health Organization, 1989a);

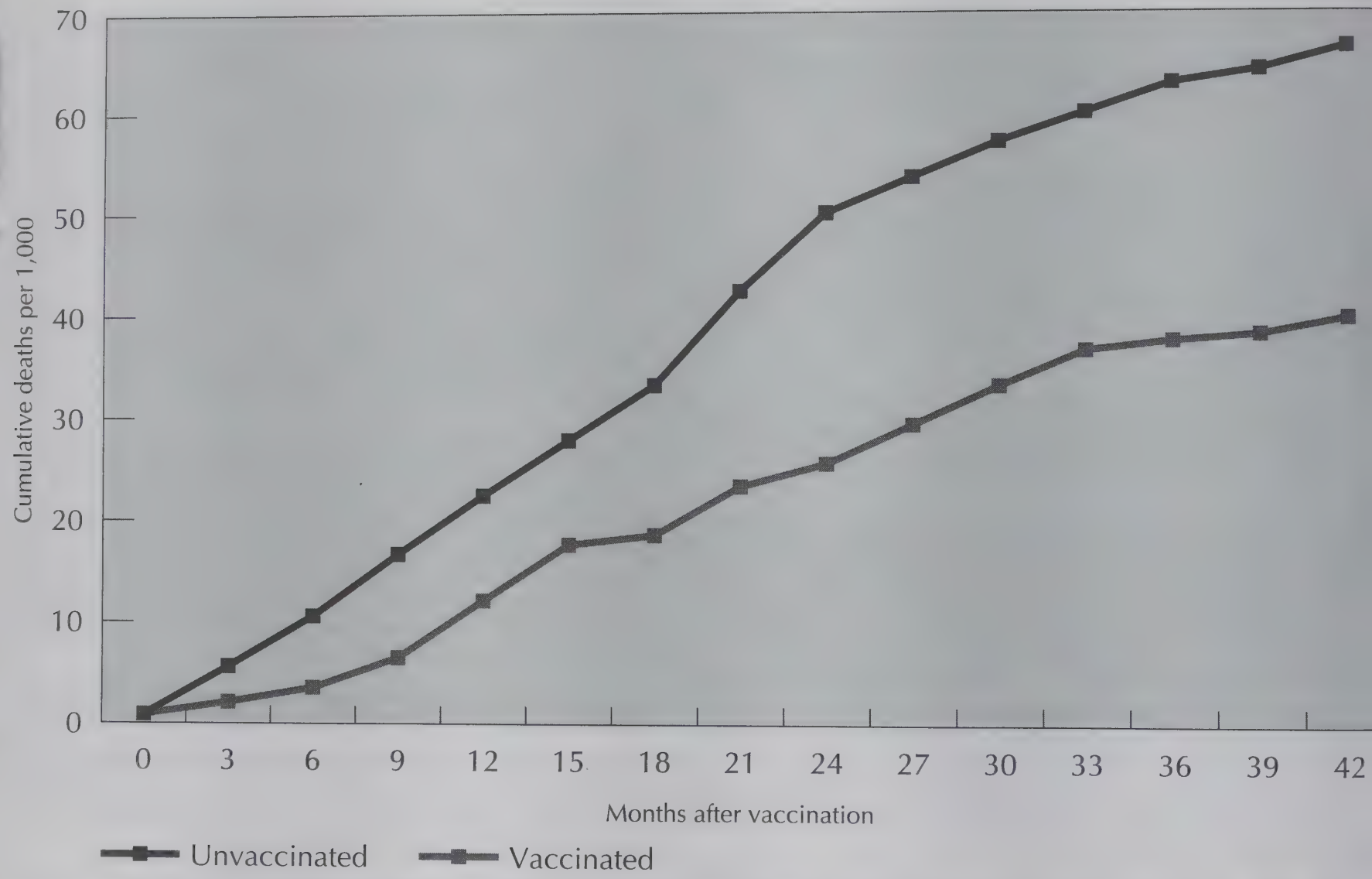

Fig 8 : Cumulative mortality rates by measles vaccination status : Matlab intervention area, 1982-85

Source : Koenig, et al. 1990

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Measles in Matlab

ii) the capacity of the new vaccines to induce seroconversion at early ages, and to sustain it throughout childhood; and

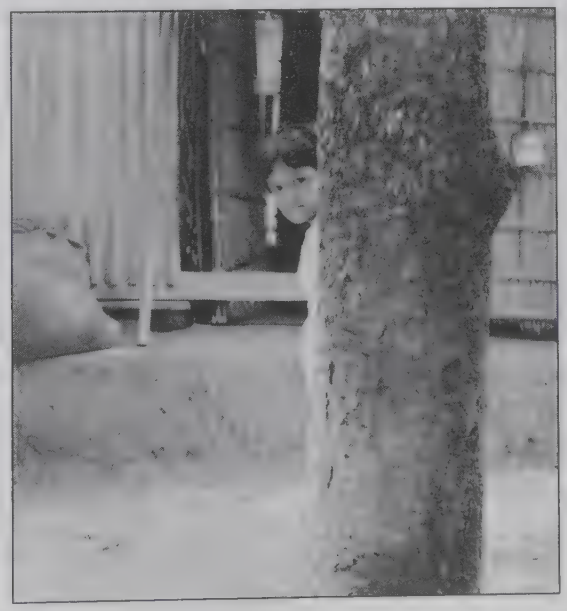
iii) the capacity of immunization programmes to achieve a high coverage rate in children as young as 5 months.

The decision to modify immunization strategy is about to be taken in many developing countries because studies based on age-related data have demonstrated its importance for public health. Such studies have now been initiated in Bangladesh.

New strains of measles vaccines have been tried in Africa (Aaby, *et al.*, 1988; Garenne, *et al.*, 1991; Whittle, 1988a) and in Latin America (Markowitz, *et al.*, 1987). The authors of the trial in Senegal reported an increased mortality in the 2 groups that had received a high-titre E-Z vaccine as well as a high-titre Schwarz vaccine at the age of 5 months, as compared to the group that had received the conventional Schwarz vaccine at 9 months of age.

This finding raised ethical issues about the continuation of measles-vaccine trials using high-titres of the new vaccine strains given earlier than 9 months of age.

In view of the public health importance of measles before the age of 9 months in Bangladesh, and the benefits for child survival that can be obtained by an effective and safe vaccination at the age of 5 months, it is still justified to consider an alternative vaccine, such as AIK-C. A trial for such a vaccine will require careful design, monitoring, and follow-up procedures to ensure safety (EPI, 1991). ■



Measles: no longer lurking round every corner.

Measles in Matlab

CHAPTER 11

Measles in Matlab

Vincent Fauveau

Lessons learned and recommendations for further research

Measles outbreaks in Bangladesh follow a constant seasonal cycle with peak incidence in March and peak mortality a few months later.

The peak age for both incidence of measles and case-fatality in rural Bangladesh is at 5 months of age.

One fifth of all cases of measles in children aged less than five years occurs below the age of 9 months which is the usually recommended age for measles vaccination.

Clinical validation (and confirmation) is more difficult at ages below 5 months than in older children, leaving doubts about the validity of cases reported in young infants.

Measles and diarrhoea have a synergistic interaction resulting in increasing severity in young infants.

In a poorly-immunized community, approximately 15 per cent of child deaths are attributable to measles or its complications.

In the absence of an intensive and effective immunization programme, approximately 75,000 children are expected to die of complicated measles each year in Bangladesh.

Male children have significantly greater measles vaccination coverage rates than female children.

In two controlled studies conducted in Matlab, the protective efficacy on overall mortality of measles vaccination has been estimated to be between 36 and 46 per cent.

Further research should focus on the following:

* *intra-community transmission of measles,*
* *validation of cases in very young infants,*
* *community attitudes towards vaccination, including gender differentials,*
* *the dynamics of maternal antibodies in Bangladeshi infants,*
* *field efficacy of new measles vaccines given at five months of age (AIK-C),*
* *interventions to decrease measles case-fatality, including evaluation of the effect of vitamin A administration at initial stages of clinical measles,*
* *cost and cost-effectiveness of measles vaccination.*

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CHAPTER 12

Child Malnutrition in Matlab: Some Key Questions

Andre Briend
Vincent Fauveau

Although it is not usually mentioned in the list of the main "killers" (diarrhoea, acute respiratory infections, measles, malaria), malnutrition is often presented as the most important underlying cause of child mortality. Indeed there are several gradations in malnutrition, from the imperceptible to the most severe forms, from the single-nutrient deficiency to the complete lack of food. The focus of this paper is on the relationship between malnutrition and the risk of death, in the light of research done in Matlab. Another important area, the prevention of malnutrition in the community, is not developed in the paper because it has received less attention in field studies.

Several key questions are to be raised about nutrition and child health in rural Bangladesh:

1) ***How important is malnutrition as a cause of death among children aged less than five years in rural Bangladesh?***

2) ***Can children at risk of dying from severe malnutrition be easily recognized? Can some nutritional interventions be specifically targeted on these children?***

3) ***What are the causes of malnutrition: Is it just the lack of food? Or, is malnutrition the consequence of repeated infections and especially diarrhoeas?***

4) ***How effective is breast feeding to prevent malnutrition in rural Bangladesh?***

5) ***What can be done, in practice, now, to prevent malnutrition-related deaths in rural Bangladesh?***

PART II

Studies from Matlab relevant to these questions are discussed in this review focusing on findings with programmatic implications. Areas needing further research are also highlighted.

1. HOW IMPORTANT IS MALNUTRITION AS A CAUSE OF DEATH AMONG UNDER-FIVES IN RURAL BANGLADESH?

Malnutrition is often presented as the underlying cause of the high mortality observed in poor countries but until recently, few data were available to sustain this view.

Some authors claimed that the small size of children in the Indian subcontinent may be the result of an adaptation to an all-time low food availability and that, to some extent, children classified as "malnourished" by anthropometric criteria can be "small but healthy" (Seckler, 1982). A few studies done in Matlab on the relationship between malnutrition and mortality help to clarify this issue.

Assessing retrospectively the contribution of malnutrition as cause of death is difficult, since malnutrition is rarely mentioned by the family as one of the factors leading to death. Longitudinal studies with assessment of the nutritional status at the beginning of a follow-up period are needed to determine whether malnutrition is an important risk factor for death. These studies are difficult to carry out in places were vital events, such as births, deaths, migration, are not routinely recorded.

The Matlab field station with its Demographic Surveillance System is well-suited for this type of work. Actually, Matlab was the venue of several pioneer studies in this field. They provided an estimation of the role of malnutrition as a cause of death.

1.1. METHODS

All the studies done in Matlab on the relationship between nutritional status and mortality had a common design. First the nutritional status of a group of children was measured and each child was classified in a high-risk or low-risk category according to whether he was below or above a chosen nutritional cut-off point (Table 1, below).

At the end of the follow-up, the numbers of children who died in

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TABLE 1

Study design needed to assess prospectively the role of malnutrition as a risk factor for mortality

	Number of children at the beginning of follow-up	Number of children who died during follow-up
Malnourished children: below cut-off point	n1	d1
Well-nourished children: above cut-off point	n2	d2

each category were determined. This common design makes possible a similar analysis for all these studies and facilitates comparisons, although some of the measures of association between malnutrition and the risk of dying presented here were not always presented in the original publications.

The Relative Risk (RR) of dying for malnourished compared to well-nourished children can be calculated by the ratio:

$$RR = \frac{(d1/n1)}{(d2/n2)}$$

The proportion of deaths attributable to malnutrition (or attributable risk) can then be calculated from the formula :

$$AR = \frac{P \times (RR-1)}{P \times (RR - 1) + 1}$$

where P is the proportion of children in the "malnourished" category:

$$P = \frac{n1}{n1+n2}$$

Methods of estimation of the 95 per cent confidence interval of relative and attributable risk are described in the literature (Kleinbaum, *et al.* 1982; Walter, 1978).

Three longitudinal studies of this kind took place in Matlab. Their main characteristics are reported in Table 2 (below). The study by Sommer and Loewenstein (1975) was the first ever to link prospectively nutritional status with the risk of dying. It used the QUAC stick classification to assess the nutritional status. This index, first used during the Biafra famine, was designed for the rapid assessment of wasting by relating mid-upper-arm circumference (MUAC) to height instead of calculating the classical weight for height index.

TABLE 2

Characteristics of longitudinal studies on the relationship between nutritional status and mortality done in Matlab.

Authors[1]	Nutritional indices used	Age range	Duration of follow-up
Sommer & Lowenstein, 1975	QUAC stick	1 to 9 years	6 months
Chen, *et al.* 1980	Weight-for-age, Weight-for-height, Height-for-age Arm circumference for age	12-23 months	2 years
Briend, *et al.* 1987	Arm circumference	6-36 months	1 month

[1] The year refers to the date of publication.

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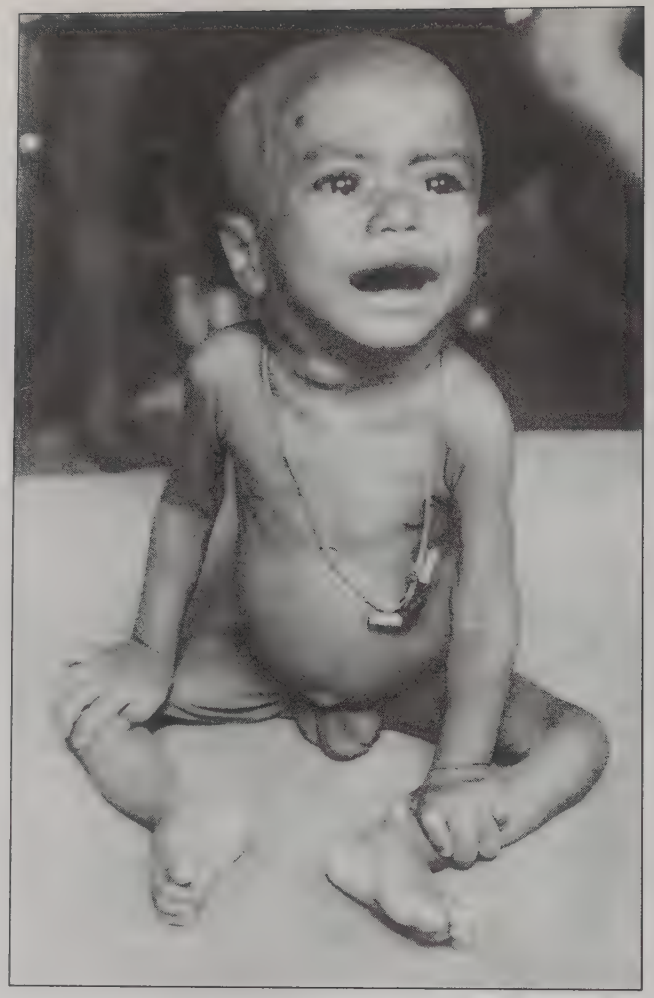

Malnutrition is an underlying factor in more than one-third of all deaths of children aged 6 to 36 months in Matlab.

Close monitoring of children s health has led to fewer deaths and healthier children.

1.2. RESULTS

Results of the three studies are reported in Tables 3 to 5 (below and following pages). Confidence intervals of the relative risks and attributable risks were not presented in the original papers of the first two studies and were calculated from the tables.

1.3. DISCUSSION

All studies done in Matlab show that malnutrition defined by a low value of any anthropometric index is associated with a higher risk of dying. The small size of Bangladeshi children compared to an international standard cannot be regarded as benign or as a successful adaptation to a low food availability.

The proportion of deaths attributable to malnutrition obtained from these studies varies according to the nutritional index and to the cut-off used to measure malnutrition.

Results obtained from the QUAC stick, weight-for-age and MUAC, all indices closely related to the risk of dying, are fairly consistent in the three studies. However, they suggest that one to two thirds of child deaths in Matlab are attributable to malnutrition.

These results must be taken carefully: the proportion of deaths attributable to malnutrition obtained by this approach can be over-estimated if the association between malnutrition and the risk of dying is biased by a third factor which may be both related to higher mortality and poorer nutritional status, such as a low socio-economic level.

The last study by Briend, *et al.* (1987) reported the highest proportion of deaths attributable to malnutrition. This may be related to the use of MUAC, which is the nutritional index most closely related to the risk of dying (see below) and also to the short duration of follow-up.

TABLE 3

Relative risk of dying in different QUAC stick categories and proportion of deaths attributable to malnutrition in Sommer & Lowenstein study, Matlab, 1970-71.

Nutritional status at the beginning of follow-up (percentiles)	Number of children at the beginning of follow-up	Deaths during follow-up	Relative risk of dying
<9 th	253	31	4.47 (3.01-6.65)
10-50th	1570	70	1.63 (1.15-2.30)
>= 50th	1934	53	1

Proportion of deaths attributable to malnutrition:
33.1 % . 95% CI = 18.8 % - 47.4 %

In this table, only 1-to-4-year-old children were included.

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TABLE 4

Nutritional status according to weight-for-age, weight-for-height and height for age, relative risk of dying and proportion of death attributable to malnutrition in Chen, *et al.* study, Matlab, 1975-77.

a) Weight-for-age

Weight-for- age at the beginning of follow-up (percentiles)	Number of children at the beginning of follow-up	Deaths during follow-up	Relative risk of dying
<60 % (severe)	427	48	3.07 (1.90-4.95)
60-75 % (moderate)	1046	44	1.15 (0.68-1.93)
>= 75 %	546	20	1

Proportion of deaths attributable to malnutrition: 33.9 % (8.2 % - 59.6 %)

b) Weight-for-height

Weight-for- height at the beginning of follow-up (percentiles)	Number of children at the beginning of follow-up	Deaths during follow-up	Relative risk of dying
<=70 % (severe)	75	11	2.79 (1.42-5.49)
70-79 % (moderate)	566	28	0.94 (1.63-0.54)
80-89 % (mild)	979	52	1.01 (0.63-1.62)
>= 90 %	399	21	1

Proportion of deaths attributable to malnutrition: 5.1% (-30.5 % - 40.7 %), not significantly different from 0

c) Height-for-age

Height-for- age at the beginning of follow-up (percentiles)	Number of children at the beginning of follow-up	Deaths during follow-up	Relative risk of dying
< 85% (severe)	468	53	3.44 (1.61-7.32)
85-89 % (moderate)	713	27	1.15 (0.48-2.73)
90-94 % (mild)	656	26	1.20 (0.50-2.87)
>= 95 %	182	6	1

Proportion of deaths attributable to stunting: 40.5 % (-4.9% - 86 %), not significantly different from 0 %

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TABLE 5

Risk of dying according to the mid-upper arm circumference (MUAC) category and attributable risk for different definition of malnutrition, from Briend, *et al.* study (1985-86).

Mid-upper-arm circumference category	Relative risk of dying [1]	Proportion of deaths attributable to malnutrition (%)
=< 100 mm	48.0 (35.1 - 65.7)	41.4 (27.8 - 55.0)
=< 110 mm	20.1 (13.7 - 29.5)	52.9 (38.6 - 67.3)
=< 120 mm	11.1 (6.6 - 18.5)	69.9 (55.1 - 84.8)
=< 130 mm	6.3 (2.8 - 4.1)	76.1 (56.2 - 96.0)

[1] reference category : children above the threshold.

The study by Chen, *et al.* (1980), on the other hand, may have under-estimated the proportion of deaths related to malnutrition since children may have changed nutritional category during the long follow-up. These results are consistent with another estimation of the proportion of deaths related to malnutrition obtained by verbal autopsy (Fauveau, *et al.*, 1990). The verbal autopsy method, which tends to under-estimate the role of malnutrition, gave an estimate of 30 per cent of malnutrition-related deaths among 6-to-36-month children.

This study also showed that malnutrition-related deaths varied according to seasons, with a peak between September and January.

From their study, Chen, *et al.* (1980) suggested that moderate or mild degrees of malnutrition were not associated with increased mortality and that the risk of dying increased only beyond a threshold. The authors suggested that interventions targeted on the most malnourished children might be effective to prevent most malnutrition-related deaths. This concept, however, needs to be qualified.

The threshold phenomenon reported by Chen, *et al.* (1980) was not observed in other studies on the relationship between malnutrition and mortality: other studies suggest a non-linear but continuous increase of the risk of dying for lower categories of nutritional status.

Targeted nutritional interventions on most severely malnourished children are bound to have a smaller impact on malnutrition-related mortality than factors likely to have an influence on nutritional status of all children, including the mildly or moderately malnourished, such as fluctuations of food availability.

The association between malnutrition and the risk of dying may explain the long-term decline of mortality observed in Matlab, even in

CONTINUED...
Child Malnutrition in Matlab

the comparison area in the absence of important medical interventions. Evolution of the nutritional situation in Matlab can be examined by comparing all nutritional surveys done during the last twenty years.

Occasional nutritional surveys were carried out for research purposes in the early seventies and eighties and since 1988, a nutritional surveillance system has been initiated and regular information on the nutritional situation is available.

There is a highly significant improvement of children's nutritional status (Figure 1, facing page). This change seems related to improved food availability, and not to the implementation of MCH-FP activities, since there does not seem to be a difference of nutritional status between the intervention and the comparison areas.

The mortality decline observed after 1986 can also partly be explained by the implementation of a vitamin A supplementation programme, both in the intervention and the comparison areas, to eliminate nutritional blindness in the Matlab area.

2. CAN CHILDREN AT RISK OF DYING FROM MALNUTRITION BE EASILY RECOGNIZED? CAN SOME NUTRITIONAL INTERVENTIONS BE SPECIFICALLY TARGETED ON THESE CHILDREN?

CONTINUED...
Child Malnutrition in Matlab

Severe malnutrition defined by any nutritional index is associated with an increased risk of dying. Each attempt to assign a child in the low or the high-risk category, however, is associated with a possibility of misclassification. To improve the screening of high-risk children, attempts should be made to reduce the number of these classifications. This can be done by comparing the sensitivity-specificity curves of different nutritional indices to assess the risk of dying. This approach was used for the first time in Matlab by Bairagi (1981) with the data of the study by Chen, *et al.* (1980).

2. 1. METHODS

Sensitivity of a nutritional index to assess the risk of dying can be defined as its ability to correctly identify children who will die during the follow-up. Its specificity represents its ability to correctly identify children who will survive. Calculation of sensitivity and specificity is shown in Table 6 (below). They are often expressed as percentages.

Sensitivity and specificity are inversely related: when a higher cut-off point is chosen, sensitivity increases whereas specificity decreases. By using different cut-off points, a plot can be made of sensitivity against specificity for each nutritional index. The index with the highest curve is the most appropriate to identify high-risk children.

2.2.. RESULTS

The plot derived from Chen, *et al.*'s study (1980) by Bairagi (1981) is reproduced in Figure 2 (overleaf). It shows that at high levels of specificity, MUAC is the most sensitive indicator to identify high risk children.

2. 3. DISCUSSION

The capacity of MUAC to identify children with a high risk of dying shown in this first study from Matlab was confirmed by other studies

TABLE 6

Definition of sensitivity and specificity of nutritional indices for identifying children with a high risk of dying.

	Died	Survived
High-risk children (below cut-off)	a	b
Low risk children (above cut-off)	c	d
Sensitivity = a/(a+c) Specificity = d/(b+d)		

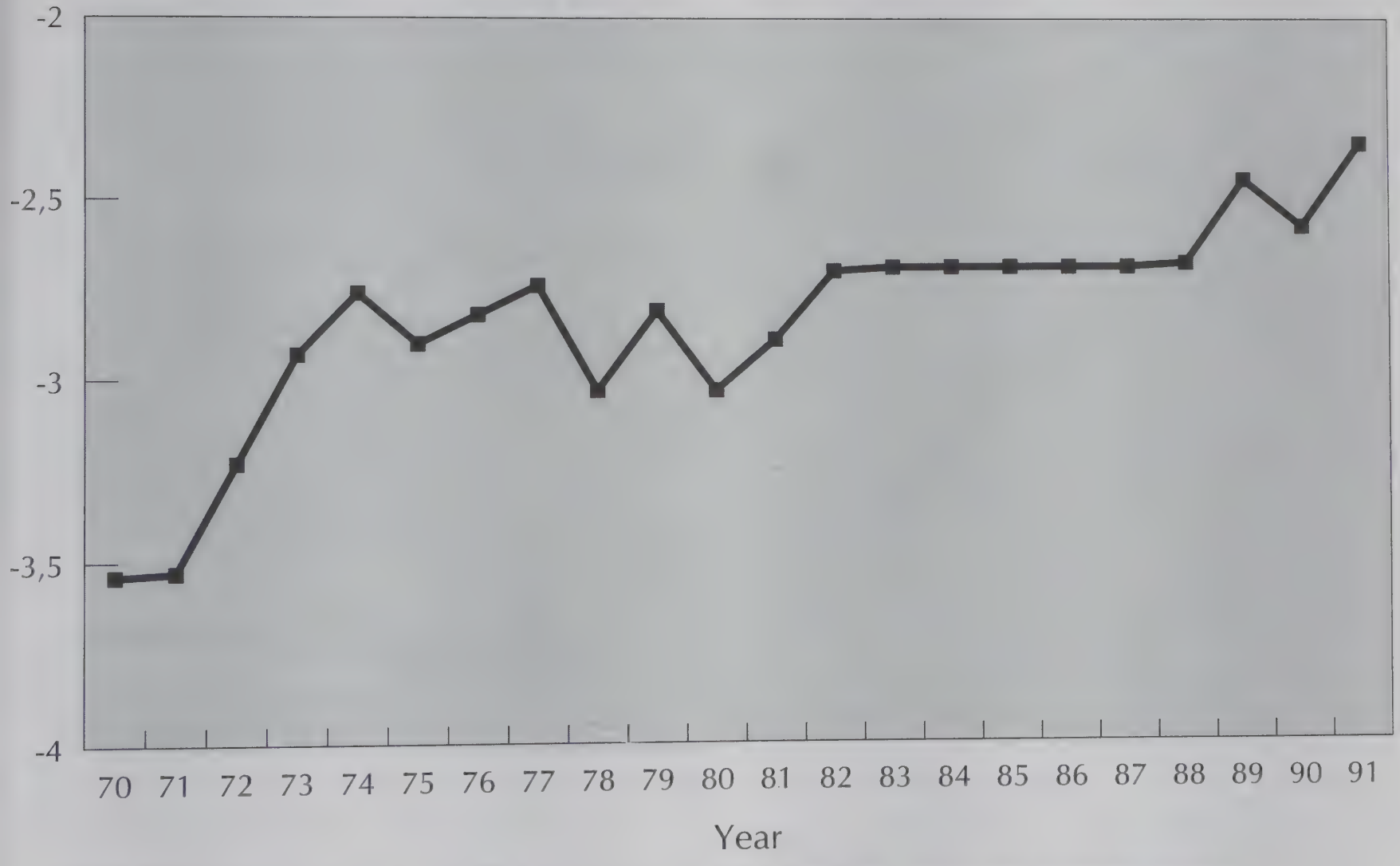

Fig 1: Long term trends of nutritional status in Matlab, assessed by mean height for age Z score of children aged 12 to 36 months.

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Child Malnutrition in Matlab

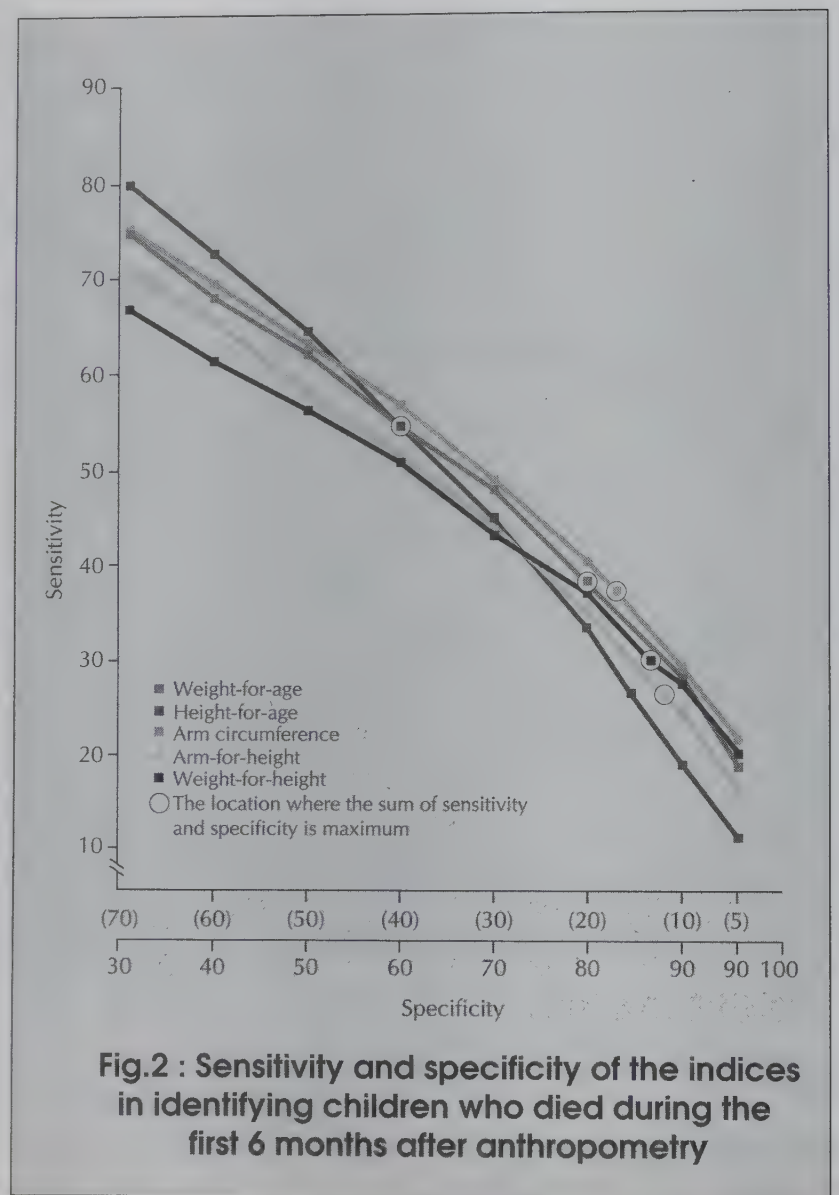

Fig.2 : Sensitivity and specificity of the indices in identifying children who died during the first 6 months after anthropometry

in Bangladesh and elsewhere (Trowbridge & Sommer, 1981; Briend, *et al.*, 1986; Alam, *et al.*, 1989; Briend, *et al.*, 1989a). This suggests that MUAC measurements, especially when used at short intervals (Briend & Zimicki, 1986), can be used to identify at best high-risk children. This could be shown by the study by Briend, *et al.* (1987) where monthly measurement of MUAC could identify children with a high sensitivity and specificity. However, these studies on detection of severely malnourished children raise two questions:

a) What could be done in terms of intervention among children identified as having a high risk of dying?

Following the results of Briend, *et al.*'s study, a nutrition rehabilitation unit was opened in Matlab in 1986 to refer the most severely malnourished children. This unit could accommodate about ten children with their mothers. Although the average duration of stay was limited by practical constraints to twenty days, no more than fifteen children per month could be treated. Although the efficacy of the unit has never been formally evaluated, it is clear that the numbers of severely malnourished children that can be reached and treated by this approach is bound to be low. Designing some community-based intervention aiming at reducing mortality in this high-risk group should be a research priority.

b) What could be done to identify high-risk children before they become severely malnourished?

Rather than identifying children once they are severely malnourished and difficult to treat, it would seem *more sensible* to recognize these high-risk children before they reach that stage. This approach, however, is difficult because the identification of children who will become malnourished remains, so far, imprecise. Two lines of research have been pursued with that objective:

- ***Use of socio-economic indicators to detect high-risk children.***

  Malnutrition is associated with poverty and in rural Bangladesh there is a statistically-significant association

between socio-economic indicators and malnutrition (Bhuiya, *et al.*, 1986). This association, however, does not seem to be strong enough to reliably identify children who will become malnourished.

A case-control study done in Matlab by Henry, *et al.* (1992) showed that an intervention aimed at children selected on the basis of these indicators would miss a high proportion of children who will eventually become malnourished.

■ ***Use of serial measures of malnutrition to detect early stages of malnutrition.***

WHO and UNICEF recommend serial measures (sequential every month) of nutritional status to detect high-risk children at an early stage. Research done in Matlab (Bairagi, *et al.*, 1985) and elsewhere in Bangladesh (Briend, *et al.*, 1989; Henry, *et al.*, 1989) showed that variations of nutritional status are of little value to assess the risk of dying and to predict future nutritional status.

A single measurement of weight at 6 months of age seems more effective to predict future nutritional status than repeated measures.

The usefulness of early measuring of arm circumference to predict the risk of future malnutrition has never been assessed. If some technique of early identification of children at risk of becoming malnourished could be developed, it would be important to test interventions aiming at preventing malnutrition in this high-risk group.

The dilemma posed by the detection of malnourished children is represented in Table 7 (below) Early detection of malnutrition is imprecise which means that intervention must reach a high number of children to reach those who eventually will become malnourished.

Detection of high-risk children leads to the selection of smaller numbers of children for intervention, but these children need closely supervised and costly interventions to improve. The right

TABLE 7

Comparison of different possible approaches for the detection of malnourished children.

	Detection of children at risk of becoming severely malnourished	**Detection of severely malnourished children**
Technique to be used.	Socio-economic indicators of little value. Early anthropometry should be preferred.	Measure of MUAC used with a low cut-off value to make it specific.
Precision.	Fair.	Good: small number of children identified.
Intervention.	Could be home-based. Cost may be high given the number of children to treat.	Treatment needs close supervision and must be clinic-based. Bound to be costly.

CONTINUED...

compromise between the different possible approaches has not yet been defined. Research into cost-effectiveness is needed to answer some of these questions.

3. WHAT ARE THE CAUSES OF MALNUTRITION IN RURAL BANGLADESH:

IS IT JUST THE LACK OF FOOD? OR, IS MALNUTRITION THE CONSEQUENCE OF REPEATED INFECTIONS?

Whether malnutrition is due mainly to a lack of food or results from repeated infections is still debated. Food is often lacking in the poorest communities but infections, and especially diarrhoeas, are highly prevalent and have a negative impact on growth.

It has been postulated that programmes aiming at reducing infection-prevalence may be more effective in reducing malnutrition than nutritional programmes themselves (Keusch & Scrimshaw, 1986).

Diarrhoea-control programmes have been prioritized as a result of this hypothesis since epidemiological studies suggest that, among common infections, diarrhoea have the largest effect on growth (Rowland, *et al.*, 1977). Several studies from Matlab are relevant to this debate.

CONTINUED...
Child Malnutrition in Matlab

3. 1. Cross-sectional survey on socio-economic differentials in child nutrition in Matlab.

First, a cross-sectional study on socio-economic differentials in child nutrition and morbidity (Bhuiya, 1983; Bhuiya, *et al.*, 1986) showed that malnutrition was more prevalent in the poorest socio-economic groups although morbidity patterns had no socio-economic differentials.

In the same way, more girls than boys were found to be malnourished, although there was no sex difference in morbidity prevalence. On this basis, Bhuiya (1983) stated that the hypothesis of poor nutrition among the children of lower status due to higher disease incidence was not tenable.

In the same study, child nutritional status was found to be independent of the source of household water and use of latrine but related to other indicators of household wealth: size of landholding, cows, boats and modern appliances.

This, again, somewhat supports the role of food availability rather than domestic hygiene and diarrhoea frequency as the most important determinant of nutritional status. Conclusions of this cross-sectional study were confirmed by longitudinal studies on the relationship between malnutrition and diarrhoea.

3. 2. Longitudinal studies on the relationship between diarrhoea and growth.

Longitudinal studies (prospective design) are the most appropriate to study the association between two events which may be linked by two-way causal relationship, such as diarrhoea and malnutrition. Two major studies of these type were done in Matlab by Black, *et al.* (1984a) and by Bairagi, *et al.* (1987) . Their results will be discussed along with those of associated food intake studies.

3. 2. 1. Data and methods

These two studies have some common methodological characteristics: In both studies, a group of children was followed up with regular anthropometric measurements and routine morbidity information was collected and then the weight gain of children in intervals with and without diarrhoea was compared.

These studies took place in different villages of the Matlab area and their design and the statistical analysis were slightly different (Table 8, facing page).

3. 2. 2. Results

Results of these two studies are shown on the facing page in Tables 9 and 10 (overleaf): Both show that diarrhoea has a marked impact on weight gain measured at short intervals of one or two months but this effect is not statistically significant when examined at longer intervals.

In the Black, *et al* study, only Shigella diarrhoeas were associated with lower height gain at one-year intervals but this effect was quantitatively small and not large enough to be reflected in weight gain. These two studies also examined the relationship between malnutrition and the risk of diarrhoea. Both showed that malnutrition is a determining factor of diarrhoeal duration, but not incidence (Black, *et al.*, 1984b; Bairagi, *et al.*, 1987; Chowdhury, *et al.*, 1990).

3. 3. Studies on the relationship between food intake, diarrhoea and growth.

The relationship between food intake, diarrhoea and growth was described in detail in three papers (Brown, *et al.*, 1982; Brown, *et al.*, 1985; Becker, *et al.*, 1991) derived from food consumption surveys done on 59 children aged 5 to 18 months chosen from those followed in the study by Black, *et al.* (1984a) and 11 additional children from the same villages.

TABLE 8

Comparison of data and methods of the two Matlab studies on the effect of diarrhoea on growth.

	Black, *et al.*, 1984	Bairagi, *et al.*, 1987
Date of field work	**1978-79**	**1976 (post-1974-75 famine)**
Number of children	197	about 1000
Age range	2-48 months	1 to 4 years
Frequency of weight measurement	every month	every 2 months
Collection of morbidity information	every 2 days	weekly
Statistical analysis	Comparison of weight gain in 2-month intervals with and without diarrhoea. Use of stepwise regression model to assess short-term and long-term effect of diarrhoea on growth.	Comparison of weight gain in 2-month and 8-month intervals in relation to diarrhoea prevalence.

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Table 9

Results of Black, *et al.*'s (1984) study.

a) Stepwise regressions of change in weight and height status in 60-day intervals.

Dependent variable	Independent variables tested	Significant variables
Change in weight status	% of days with diarrhoea associated with Escherichia coli, Shigella, rotavirus or without a pathogen found	E. coli diarrhoea
Change in height status	Same	None

b) Stepwise regressions of change in weight and height status in one year.

Dependent variable	Independent variables tested	Significant variables
Change in weight status	% of days with diarrhoea associated with Escherichia coli, Shigella, rotavirus or without a pathogen found	None
Change in height status	Same	Shigella diarrhoea

Table 10

Results of Bairagi, *et al.*'s (1987) study.

a) Weight and height gains in 2-month intervals in relation to percentage of days with diarrhoea in the interval

Percentage of days with diarrhoea	Weight gain (g)	Height gain (mm)
0%	168±15	0.68±0.05
1-10%	136±26	0.70±0.13
>= 11%	112±58	0.53±0.12

Effect of diarrhoea on short term weight gain significant ($p<0.05$).

b) Weight and height gains in 8-month intervals in relation to percentage of days with diarrhoea in the first two months of the interval:

Percentage of days with diarrhoea in the first two months of the interval	Weight gain (g)	Height gain (mm)
0%	141±4	0.52±0.02
1-10%	148±8	0.54±0.02
>= 11%	139±12	0.56±0.04

None of these differences is statistically significant.

CONTINUED...

3. 3. 1. Methods

These dietary surveys took place once a month. Dietary intake was measured by weighing all food consumed by the child during the entire day of the study. These studies lasted from sunrise, when the child first awoke, until sunset, when children were put to sleep for the night.

Raw food ingredients were weighed on a beam balance scale accurate to 0.1 g and cooked menu items were weighed again after preparation. The child's portion was weighed before serving and left-over food was subtracted from the serving to estimate the amount of food eaten.

Nutrient intake was calculated from the amount of menu items consumed by the child and the nutrient content of the different food items derived from Indian food composition tables when available or else from other sources. The consumption of breast-milk during a 12-hour period was calculated by test-weighing. Total breast-milk consumption over 24 hours was extrapolated from the 12-hour consumption using a correction factor (12-h consumption/0.53) derived from a previous study. Multiple linear regression was used to determine the effect of season and selected illnesses on nutrient intake.

3. 3. 2. Results

a) **Consumption of foods and nutrients by weanlings in rural Bangladesh** (Brown, *et al.*, 1982).

Children in this study were found to consume an average energy intake between 63 to 71 kcal/kg body weight/day and an average intake of protein between 1.2 and 1.5 g protein/kg body weight /day in the various age and sex category.

Measuring food intake in relation to body weight may, however, under-estimate the food intake deficit since body weight itself may be reduced as a result of inadequate food intake. To avoid this problem, the authors also expressed the nutrient intake of Bangladeshi children as a percentage of the dietary allowances for well nourished children of the same height. Estimates varied between 50 per cent and 55 per cent of requirements for energy and 62 per cent to 88 per cent for proteins in different age and sex categories.

b) **Effect of season and illness on the dietary intake** (Brown, *et al.*, 1985).

The inclusion in a multiple regression model of days during the surveys when the child was ill showed that energy intake was significantly reduced by 9.7 per cent when the child had a fever.

Other illnesses had no significant effect on food intake. Diarrhoea was associated with only a non-significant 2.7-per-cent reduction of energy intake. In contrast, season had a marked effect on food intake: average energy consumption was on average one-third greater during the post-harvest compared to the pre-harvest period.

c) **Effects of diarrhoea, fever and dietary energy intake on weight gain** (Becker, *et al.*, 1991).

This analysis used a multiple regression model with random effect to examine the respective effects of diarrhoea, fever and energy intake on the growth of children on 30-day intervals. It estimated that the elimination of diarrhoea would increase monthly weight gain by 11 g. On the other hand, if energy intakes were at the levels recommended by WHO, weight gain would increase by 49 g. Elimination of febrile illness would have increased weight gain by 25 g.

3. 4. Discussion on the relationship between diarrhoea, malnutrition and growth in rural Bangladesh

Considered together, studies done in Matlab lead to the conclusion that lack of food, rather than frequent diarrhoea, is the major cause of malnutrition among weanlings in rural Bangladesh.

CONTINUED...
Child Malnutrition in Matlab

Longitudinal studies on the relationship between growth and diarrhoea suggest that diarrhoea has only a transient effect on growth. Bairagi, *et al.* (1985) explained these findings by postulating the existence of catch-up growth taking place after episodes of diarrhoea.

This interpretation was confirmed a few years later by another study from ICDDR,B in the Mirzapur area which also gave evidence in favour of catch-up growth after diarrhoea (Briend, *et al.*, 1989).

The study by Black, *et al.* (1984a) also showed that diarrhoea caused by enterotoxigenic Escherichia coli had the most profound effect on short-term but no effect on long-term weight gains.

This observation may be related to water and electrolyte loss during diarrhoea and contrasts with shigella infections which had an effect only on long-term height gain but no effect on weight gain.

Dietary surveys in Matlab showed that the diet of weanlings was grossly inadequate even in the absence of illness (Brown, *et al.*, 1982). Diarrhoea when present had little effect on food intake (Brown, *et al.*, 1985).

Examined at short time intervals, low food intake, and not diarrhoea, seem to be the most important cause of the slow rate of growth of children in rural Bangladesh (Becker, *et al.*, 1991) although the examination of growth data at short time intervals tends to over-estimate the effect of diarrhoea on growth (Briend, 1990). These results do not detract from the importance of improving food hygiene, appropriate weaning, food technology, water supply and sanitation or reducing deaths from dehydration: these measures may lead to a reduction of mortality.

CONTINUED...
Child Malnutrition in Matlab

However, these studies suggest that the contribution of diarrhoeal disease control towards improving nutrition may be smaller than previously thought (Anonymous, 1991).

These results suggest that improving the diet of young children remains the most promising approach to reducing child malnutrition in rural Bangladesh. This implies better food availability at the family level but also better intra-family food distribution. The risk of dying from severe malnutrition is more than twice as high among girls as among boys (Fauveau, *et al.*, 1990). Families have the food and the knowledge needed to reduce substantially malnutrition-related mortality, could cultural barriers discriminating against girls be overcome.

4. HOW EFFECTIVE IS BREAST FEEDING TO PREVENT MALNUTRITION AND REDUCE MORTALITY IN RURAL BANGLADESH?

The protective effect of breast feeding in infants is not disputed: there is ample evidence that breast feeding in infants is associated with the lower prevalence of diarrhoea and lower mortality (Feachem & Koblinsky, 1984). Over one year of age, however, the protective effect of breast feeding against diarrhoea is not so strong (Feachem & Koblinsky, 1984; Rao & Kanade, 1992).

In older children, breast feeding seems to be sometimes associated with malnutrition (Victora, *et al.*, 1984; Brakohiapa, *et al.*, 1988; Rao & Kanade, 1992). Studies in Matlab confirmed these results but showed that, nevertheless, breast feeding reduces the risk of dying up to three years of age in malnourished children.

4. 1. Data and methods

The association between breast feeding and the risk of dying was first studied in the Matlab comparison area by asking mothers of children aged 6 to 36 months every month whether they were still breast feeding and by examining the risk of dying in the following month in relation to breastfeeding status. MUAC was also measured at the time of interview. (Briend, *et al.*, 1988).

The relation between breastfeeding and prevalence of diarrhoea could be further explored by using morbidity information routinely recorded in the MCH-FP area (Briend, Fauveau and Chakraborty, unpublished data).

4. 2. Results

Breast feeding in the study by Briend, *et al.* (1988) was not associated with a marked difference in nutritional status. On average, MUAC of breast-fed children was 129 mm vs. 128 mm in non-breast-fed children. Survival, however, was significantly higher among breast fed children, in all examined age groups. The effect of breast feeding on child survival was visible, however, only in children with a low MUAC (Table 11, overleaf). In the MCH-FP area, routinely collected morbidity data do not suggest that breastfeeding was associated with a reduced diarrhoea prevalence (Table 12, overleaf).

4. 3. Discussion

This first study done in Matlab on the association between breast feeding and survival in children suggested that breast feeding improves child survival up to the age of three years. This was confirmed by results of another ICDDR,B study done in the Chandpur area, near Matlab, which also showed that the effect of breast feeding on survival was present only in severely malnourished children (Briend & Bari, 1989b).

The Chandpur study also showed that breast-fed children, although they had an improved survival rate, were slightly more malnourished than non-breast-fed children. This seemed related to a selective weaning of better-nourished children since the difference in nutritional status between breast-fed and non breast-fed children was present in the month preceding the cessation of breastfeeding in non-breast-fed children.

When these results were obtained, it was speculated that the effect of breast feeding on child survival was due to anti-infectious properties of breast milk. This interpretation is not supported however by morbidity data collected later on from the MCH-FP area.

The effect of breast feeding on survival is reminiscent of the effect of vitamin A supplementation: vitamin A improves survival but this is not associated either with a reduced morbidity or an improvement of the child's nutritional status measured by anthropometry (Rahmathullah, *et al.*, 1990; Rahmathullah, *et al.*, 1991).

Reducing the severity of diarrhoea episodes, as observed after vitamin A supplementation (Arthur, *et al.*, 1992), seems the most likely effect of breast feeding. In rural Bangladesh breast feeding has been shown to protect against vitamin A deficiency (Bangladesh Blindness Survey, 1985).

It is possible, therefore, that some of the effects of breast feeding on child survival is related to the vitamin A content of breast-milk. The association between breast feeding and survival remained very strong, however, in the Matlab area even after a 6-monthly vitamin A distribution programme reached almost universal coverage in 1986 in the area (Table 13, Page 246).

Moreover, a selective effect of vitamin A on most severely malnourished children has not been reported, to our knowledge, in supplementation trials with vitamin A.

The mechanism of the protection given by breast feeding to malnourished children remains unexplained. The effect of breast feeding on nutritional status measured by anthropometry, on diarrhoea prevalence or on vitamin A status does not seem to explain the strong association observed between breast feeding and child survival.

Identification of the mechanism involved seems important, however, if some nutrient deficiencies corrected by breast-milk is involved, their identification might open new lines of research to reduce mortality of severely malnourished children. Attention should be given to nutrients needed to detoxify free radicals produced during infection. Lack of these nutrients seems to play a major role in the pathophysiology of severe malnutrition (Golden & Ramdath, 1987).

CONTINUED...

TABLE 11

Association between breast feeding and survival in Matlab (Briend, *et al.* 1988).

a) By age groups

Age group (months)		Not breast-fed	Breast-fed	Relative risk
12-17	Child months	176	6622	-
	Deaths	0	11	
18-23	Child months	753	5108	3.39
	Deaths	3	6	
24-29	Child months	2611	5627	3.45
	Deaths	12	7	
30-36	Child months	4103	3035	1.73
	Deaths	7	3	

Pooled relative risk of dying for last three cells combined: 2.83 (95% confidence limits: 1.49-5.38).

b) for different MUAC categories.

MUAC category (mm)		Not breast-fed	Breast-fed	Relative risk
<= 110	Child months	592	984	4.16
	Deaths	20	8	
111-125	Child months	2098	6511	0.24
	Deaths	1	13	
> 125	Child months	4953	12537	0.42
	Deaths	1	6	

Relative risk of dying different from 1 only in first cell (95% CI: 1.97-8.78).

CONTINUED...

TABLE 12

Diarrhoea prevalence in different age groups in relation with breast feeding status in Matlab MCH-FP area (Briend, Fauveau & Chakraborty, 1989, unpublished data).

	Total number of child-months	Overall diarrhoea prevalence	Prevalence of diarrhoea lasting more than 8 days
12-17 months			
Breast-fed	2473	11.3 %	2.8 %
Non-breast-fed	172	6.4 %	1.2 %
18-23 months			
Breast-fed	2250	10.0 %	2.0 %
Non-breast-fed	304	7.6 %	2.6 %
24-29 months			
Breast-fed	1982	7.2 %	1.3 %
Non-breast-fed	620	7.9 %	1.9 %
30-35 months			
Breast-fed	1493	8.0 %	1.7 %
Non breast-fed	1159	7.9 %	2.8 %

Relative risk of diarrhoea for non-breast-fed children (all age groups):
All diarrhoeas: 0.91 (IC 95 % : 0.8-1.1)
Diarrhoeas lasting more than 8 days: 1.4 (IC 95 % : 0.96 -1.96)

CONTINUED...
Child Malnutrition in Matlab

The lack of effect beyond the age of one year of breast feeding on nutritional anthropometry and on morbidity prevalence can be shown by small-scale epidemiological studies. Presumably for that reason, it has been reported frequently. The effect of breast feeding on child survival, even if important from a public health point of view, can be shown only by studies done on a large population under demographic surveillance.

First, this shows the values of places like Matlab where epidemiological studies can be conducted with the help of a large-scale demographic surveillance system.

Second, it suggests that the public health importance of breast feeding may be under-estimated as a result of a reporting bias in the epidemiological literature: reports that breast feeding is not

TABLE 13

Comparison of the association between breast feeding and survival in Matlab MCH-FP area before and after 1986 when vitamin A distribution programme coverage went from 40 per cent to 90 per cent .

(Briend, Fauveau & Chakraborty, 1989, unpublished data). Case- control study, age range: 6-59 months).

a) before 1986

	Cases (died)	Controls (survived)
Non-breast-fed	105	26
Breast-fed	26	105

OR = 16.3 (IC 95% : 8.5 - 31.5)

b) after 1986

	Cases (died)	Controls (survived)
Non-breast-fed	389	126
Breast-fed	116	399

OR = 10.6 (IC 95% : 7.9 - 14.3) *Pooled OR: 11.5 (8.85 - 14.9)* *Chi-2 for heterogeneity: 1.56, ns.*

CONTINUED...

associated with an improved nutritional anthropometry nor a decreased diarrhoea morbidity after one year of age are bound to be more frequent than those showing the effect of breastfeeding on child survival.

5. WHAT CAN BE DONE IN PRACTICE NOW TO REDUCE NUTRITION-RELATED DEATHS IN RURAL BANGLADESH ? THE ROLE OF FAMILY PLANNING:

Reducing malnutrition in rural Bangladesh may prove difficult. Increasing food availability at the family level, although highly desirable, is beyond the capacity of the health sector. Improving intra-familial food distribution is hindered by socio-cultural barriers difficult to overcome in the short term. General improvement of nutritional status, however, is the factor most likely to reduce effectively malnutrition-related deaths.

Screening high-risk children with MUAC accompanied with treatment of selected children is a promising approach, although it cannot have an effect on the increased mortality observed among moderately malnourished children.

Moreover, so far no intervention has been proved effective in reducing mortality in these children. A centrally-based nutrition rehabilitation unit is culturally difficult to set up in this community, where women rarely leave their home, and this approach seems unlikely to provide a coverage large enough to have a visible effect on child mortality.

Home-based nutritional supplementation of children detected at an early stage of malnutrition is likely to be a better solution. In practice, however, operational difficulties should not be under-estimated. For the time being, ensuring that these high-risk children have a high coverage of preventive services, such as measles immunization and vitamin A distribution, is the only intervention which can be offered.

The protection of breast feeding may be the most effective approach available so far in reducing malnutrition-related deaths. In this respect, family planning may play a role.

A study done in Matlab by Huffman, *et al.* (1980) showed that after the age of 18 months, a new pregnancy is the most frequent cause of breast feeding cessation in Matlab (Table 14, overleaf).

As might be expected from these results, women in Matlab who use contraceptives tend to breast-feed their child longer than other women (Briend, *et al.*, 1991).

This suggests that family planing may improve child survival through its effect on breast feeding. This effect is also suggested by the long term trend of mortality among children aged 1 to 4 years in the Matlab area: mortality became consistently lower in the intervention area after the beginning of the family planning programme in this part of the Matlab area (Figure 3, Page 249). The effect of family planning on child survival was examined recently at the individual level in a case-control study done in Matlab (Briend, Fauveau, Chakraborty, unpublished data).

5. 1. Data and methods

This study had a case-control design. Cases were children aged 6 to 59 months who died of non accidental cause between 1984 and 1988. Each case was matched to a control child still alive on the day the case died. The first child of the same date of birth, to the nearest month, and of the same sex, found in a randomly selected village was chosen as control.

For cases and controls, information regarding breast feeding and contraceptive use in the months preceding the death of the case was collected from the CHW's record book. The number of years of formal school attendance was also noted.

CONTINUED...
Child Malnutrition in Matlab

TABLE 14

Reasons for cessation of breast feeding in different age groups (Huffman, *et al.*, 1980).

Child age (months)	Child death	Pregnancy	Not enough milk	Other[1]
0-6	97%	0%	1%	2%
7-12	80%	9%	2%	10%
13-18	57%	27%	2%	14%
19-24	15%	53%	14%	18%
25-30	9%	42%	25%	23%

Row totals: 100%

[1] *Includes infants becoming too old, or stopped willingly, infant sick, mother sick, divorced or separated from child.*

CONTINUED...

Child Malnutrition in Matlab

The relative risk of dying associated with different risk factors was estimated by the odds ratio (OR) of being exposed to this risk factor among cases and controls.

5. 2. Results

Altogether, 646 matched pairs of cases and controls were available for analysis. Bivariate comparisons showed that in the month preceding death, mothers of cases were significantly less likely to use a contraceptive method. This association between contraceptive use and child survival was present only among women who were still breast feeding (Table 15, Page 250). It remained virtually unchanged when maternal education, a possible confounder, was adjusted for by multiple logistic regression model (results not shown).

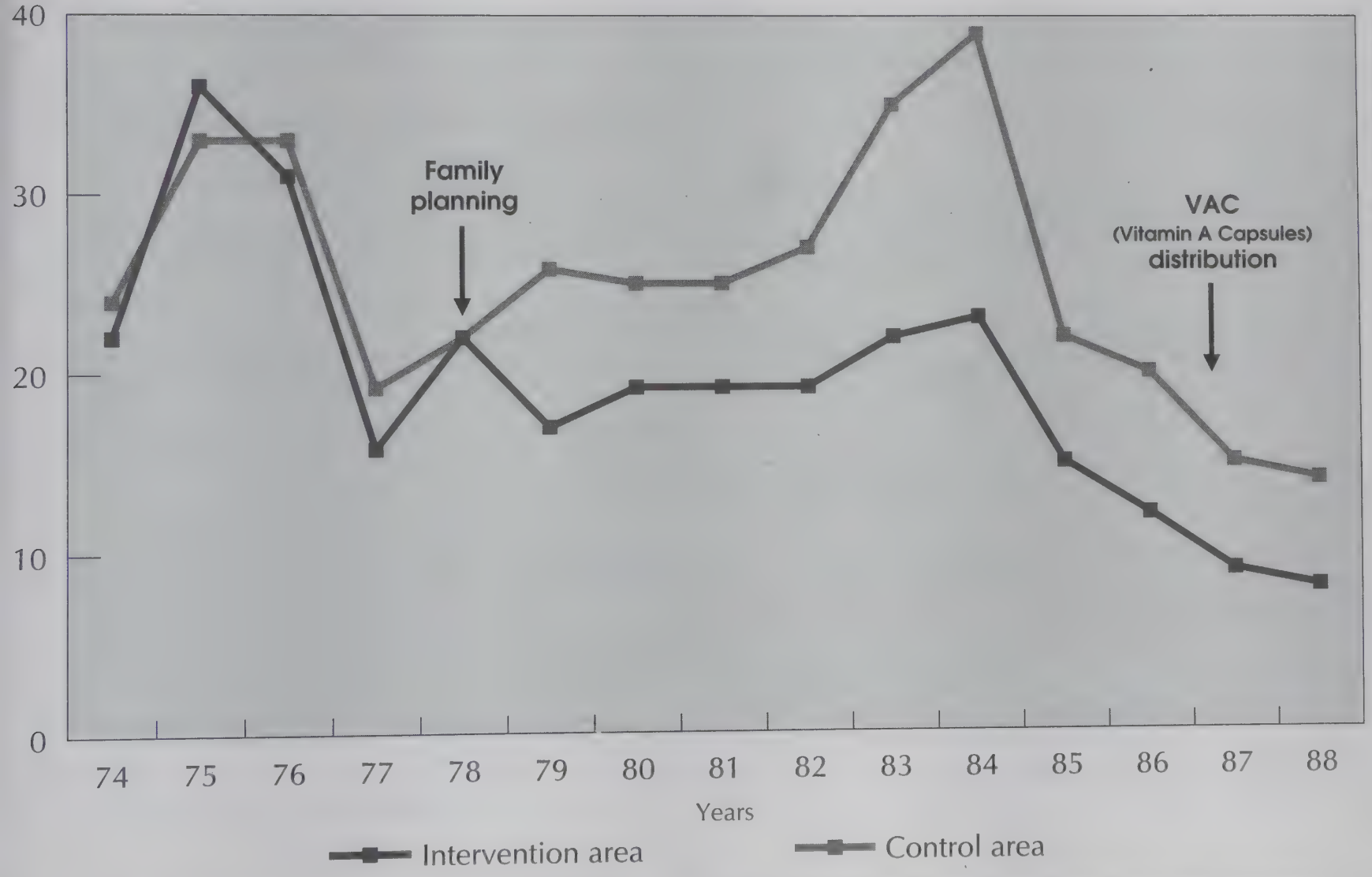

Fig 3: Trends of mortality among 1 to 4 year old children in Matlab MCH-FP and comparison areas

CONTINUED...
Child Malnutrition in Matlab

5. 3. Discussion

In this study, maternal contraceptive use was found less frequently among children aged 6 to 59 months who died, than among controls of the same age and sex. This suggests that family planning may be effective in reducing childhood mortality in rural Bangladesh.

The retrospective design of this study seems unlikely to have generated any bias, since all the information used for the analysis had been recorded before the case child died and workers who selected controls were unaware of the purpose of the study and of its design.

The effect of family planning on child survival may be different in other settings. First, the protective effect of breast feeding on child survival is clear only for severely malnourished children (Briend, *et al.*, 1988; Briend, *et al.*, 1989).

Family planning programmes may be ineffective in improving child survival in communities with a low prevalence of malnutrition.

Second, in this community, contraceptive use seems to be associated with a longer duration of breast feeding, (Briend, *et al.*, 1991) which does not seem to be the case in less deprived communities.

CONTINUED...
Child Malnutrition in Matlab

Family planning, however, may be regarded as a promising strategy for improving child survival in rural Bangladesh, where breast feeding is common and offers a high degree of protection from death associated with malnutrition.

■

TABLE 15

Comparison of the association between contraceptive use and survival in Matlab MCH-FP area in breast-fed and non-breast-fed children.

(Briend, Fauveau & Chakraborty, 1989, unpublished data. Case-control study, age range: 6-59 months).

a) Breast-fed children

	Cases (died)	Controls (survived)
Contraceptive use	49	236
No contraceptive use	103	268

OR = 0.54 (0.36-0.81), p< 0.01

b) Non-breast-fed children

	Cases (died)	Controls (survived)
Contraceptive use	168	42
No contraceptive use	326	100

OR = 1.23 (IC 95% : 0.8-1.9), ns
Chi-2 for heterogeneity: 8.32, p<0.01

Child Malnutrition in Matlab : Some Key Questions

Andre Briend
Vincent Fauveau

Lessons learned...

PROGRAMMATIC IMPLICATIONS OF THE MATLAB STUDIES:

* *Between one third and two thirds of deaths of children between the ages of 1 and 4 years in rural Bangladesh are attributable to malnutrition.*

* *Severely malnourished children with a high risk of dying can be easily identified by the measure of mid-upper-arm circumference.*

* *Measures of nutritional status variations through the use of growth charts is of little use to detect high-risk children.*

* *It seems impossible in rural Bangladesh to accurately identify children most at risk of malnutrition on the basis of socio-economic indicators only.*

* *Although they may have an impact on infant and child mortality, diarrhoea control programmes are unlikely to reduce childhood malnutrition in rural Bangladesh. Improving the diet of children remains the most promising approach to reduce malnutrition prevalence.*

* *Prolonged breast feeding is associated with an improved survival, especially in severely malnourished children.*

* *Family planning, mainly through its effects on breast feeding, seems a promising approach to reduce malnutrition related deaths in rural Bangladesh.*

SUGGESTED AREAS FOR RESEARCH IN NUTRITION IN RURAL BANGLADESH

* *Cost-effectiveness studies should determine the optimal balance between interventions at an early stage of malnutrition and those detecting high-risk children for therapeutic intervention.*

* *Operational research should be implemented to develop home-based interventions for children with a low MUAC and a high risk of dying or those with low anthropometry at 6 months and at risk of becoming malnourished. This would include research on the type of supplement to be delivered and on the delivery system itself.*

* *The mechanism of growth retardation in rural Bangladesh should be examined through repeated supplementation trials on small groups of children. The respective role of protein, energy, mineral and vitamin deficiencies should be examined. These studies should be used to adjust preventive programmes and the treatment of severely malnourished children.*

* *The mechanism of the improved survival observed in breast-fed severely malnourished children should be examined. The vitamin and mineral status of breast-fed and non-breast-fed children should be compared. Therapeutic trials or field trials should be implemented to determine the effect on child survival of nutrients, or a cocktail of micronutrients found to be present in breast-milk and for which an effect on child survival seems plausible. These studies should also be used to adjust preventive and therapeutic programmes.*

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Her smile radiating happiness, a Matlab woman smiles cheerfully as she weaves a home-made bamboo basket during one of the less hectic periods of the day...

CHAPTER 13

Perceptions of Health and Disease in the Matlab Community

Md. Yunus
K.M.A. Aziz
M. Shafiqul Islam

How health can be maintained is a concept which encompasses the realm of emotions and symbolic activities in thought and interaction through language. For example, when a person becomes ill, his family frequently relates the illness to a behaviour which has disregarded the prescriptions of the society, and the recovery of the illness is considered to be dependent on the wishes of God.

Thus, rather than consulting a medical practitioner, the ill person will pay attention to activities which will please God. This is an illustration of how an individual in Matlab views illness, what it means to him and how such meaning influences his behaviour and interaction with other members of his group.

An understanding of the psychosocial aspects of physical illness can be gained through a study of the perception of illness and its management in the community. Such aspects of illness have received little attention from the investigators engaged in studying the health of the people in Matlab. Moreover, the behavioural scientists who studied the cultural aspects of the community have rarely referred to health issues that are constantly being faced by the people (Glasse, 1964).

On the other hand, specialists in public health and epidemiology have made efforts to identify various risk factors of common diseases but have not given adequate attention to the cultural aspects of the patients' past and current relationships with their environment. Thus, how a patient experiences an illness and copes with it within the familial and social circles remains largely unknown.

This gap occurred *because the studies undertaken in Matlab were primarily biomedical in nature in the sixties and early seventies*. During this period, biomedical studies included cholera vaccine trials and epidemiological investigations into cholera and other diarrhoeal diseases (Habte and Strong, 1990). In these investigations, social and cultural aspects in relation to the acquisition and spread of diarrhoeal diseases received very little attention. It was thought that by identifying an effective cholera vaccine through field trials, it would soon be possible to control cholera.

Behaviour related to cholera was not considered important in the control of cholera.

PART III

Over the years, a comparative study of the control of cholera through vaccines or case treatment showed that provision of treatment was more feasible and cost effective than vaccination (Mosley, *et al.*, 1972, Oberle, *et al.*, 1980).

At the same time, investigations continued to look for an appropriate vaccine against cholera and for a simplification of the treatment of dehydration.

Before any further progress was made in identifying a vaccine, an easy and effective management of all dehydrating diarrhoeas became possible with the discovery of oral rehydration therapy (ORT) (Nalin, *et al.*, 1968; Cash, *et al.*, 1970; Mahalanabis, *et al.*, 1973; Rahaman, *et al.*, 1979; Snyder, *et al.*, 1982).

This opened an avenue of self-management of diarrhoeal diseases through a simple approach. So, to involve people in the effective and sustainable management of diarrhoeal diseases through ORT, an understanding of the people's perceptions regarding these illnesses and their management became important.

After the internationalization of the Cholera Research Laboratory, the scope of investigation was widened to include the areas of nutrition, child survival, maternal health, and problems of population and family planning (Habte and Strong, 1990).

CONTINUED...
Perceptions of Health and Disease

To address these problems effectively at the community level, it became important to learn about people's perceptions and behaviour about these issues. The findings of some of the studies that relate to health perceptions and behaviour will be highlighted in this chapter, though some of these studies cover many facets of the socio-economic and cultural aspects of life in Matlab.

1. BELIEFS ABOUT FERTILITY

Maloney, *et al.* (1981) undertook a study on the premise that there is a fundamental relationship between the people's system of belief and their behaviour concerning contraception and fertility. By system of belief, the authors mean the "world view" or the universal perspective that the people have, how they perceive that the power and the forces of the universe affect them, and their reactions to these forces.

World view also includes beliefs in supernatural powers, ideas sometimes called superstitions, pro-science narrative myths, philosophy, religion, and much of the traditional views of how the human body works. In Matlab, most norms of social and individual behaviour are also seen as aspects of religion.

In presenting data, the authors have put the emphasis on "religiosity" rather than on religious affiliation. Religiosity implies the intensity of genuine commitment to and practice of one's beliefs arising from one's traditional world view. Religiosity may adapt to the ecology and the economy, and to the individual's role in the cultural system, but it varies considerably among individuals.

This study used three sets of data: 1) quotations derived from in-depth life history interviews from 38 people, some of which lasted many hours in multiple sessions, during which the authors elicited the individuals' life histories, beliefs, attitudes, past and present behaviour related to sexuality and fertility, and ideas on a large number of health matters;

2) interviews with village professionals or local leaders (150 persons, including *mollahs*, midwives, healers, teachers, and family planning workers were interviewed);

3) quantitative data, obtained from 17 communities with the help of 15 field investigators who stayed in each area for five months and came to know the people. The latter community studies were scattered over Bangladesh, and included Matlab.

This study revealed that people, in a large majority, go to traditional practitioners. A Muslim may consult a herbalist

(kobiraj), or a magic healer *(ojha)*, or a mystical mendicant *(fakir)*. He may perform a ritual at the tomb *(dargah* or *majar)* of a saintly teacher *(pir)*. When people narrate stories of the local *pirs* and *fakirs*, they show how these local people have been able to bend the powers of the universe to meet human needs.

The tombs of saints are so common that one can go one morning, perform the rituals and return the same day. The people make offerings in cash or kind with the objective of 'fulfillment of a desire'. The mosque has a different function, a universalizing one, since it represents the values of the whole muslim world.

In Hinduism, Brahmins perform rituals but are not appealed to for solutions to personal problems. A *guru* (teacher) can expound religion but does not claim supernatural powers. For the solution of personal problems, people turn to the herbalist, the mystic or ascetic saint (*fakir* or *sadhu*), or the magic healer, or make a vow and perform a *puja* (worship) at a local temple.

For healing and some other problems, both Muslims and Hindus obtain amulets *(tabij)*, which are believed to cure many diseases.

One interviewee stated: *"Allah has created three thousand diseases for human beings. Of these, one thousand can be cured by 'allopathic treatment', one thousand by herbalists, and the remaining one thousand by verses from the holy Quran or an amulet, or with 'consecrated water' (pani para)."*

An amulet carries the power of incantation (*mantra sakti*). It can cause relief from sufferings and diseases and has the power to fulfill one's cherished desires. But its efficacy depends on the "intensity of faith" or flawless respect in it. An amulet is worn by a substantial proportion of the people in Matlab, as well as in Bangladesh and throughout South Asia. It is often a little locket fastened with a string around the arm, waist or neck. The following quotations are representative:

"Tabij is power"; "Tabij is a kind of medicine: it may be difficult to accept medicine, but there is no such difficulty with tabij"; "People take tabij because they benefit from it: often when the doctor's treatment fails they come running for a tabij because they find it works"; "but the tabij is only a pretext, for only God gives the cure"; "Many women get pregnant thanks to tabij": "it has such power that it can make the impossible possible".

Certain quotations regarding the usefulness of amulets in relation to maternal and child health are noted below:

"To keep the evil eye, or ghosts (bhut) from harming a pregnant woman, she uses an amulet."

"A mother procures an amulet for her child to protect him from 'stomach ailments'. If an infant develops a cold and has difficulty in breathing, then a piece of bone from the throat of a gander is used as an amulet, or a 'consecrated thread' (suta para) is used to protect the health of the child."

"If a newborn is possessed by an evil spirit (jin), an amulet is used." i.e. when all medical treatments fail as for example in the case of neonatal tetanus, the people approach the *pir* or the *fakir* to obtain an amulet.

The Muslims believe in an important evil called *iblis*, and in evil *jins*. Hindus acknowledge that evil power resides in the God and Goddess and also fear male and female ghosts. Such ghosts reside in trees or groves or graveyards and can cause harm to pregnant women and newborn babies. Amulets worn by pregnant women and babies play an important role in keeping these at bay and in counteracting their power.

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2. KINSHIP IN BANGLADESH

Aziz (1979) undertook the first substantial work on kinship in Matlab. The purpose of the study was to describe the kin

terminologies and family structures, especially with respect to the behavioural correlates. The analysis was based on data obtained from personal observations, interviews and census information.

This study revealed a general reluctance to spend money on the treatment of sick female members of the households. Frequently for treatment the females had to depend on religio-medical services offered by spiritual persons at almost no cost.

In explaining the higher mortality among females the study highlighted the importance of the pattern of food distribution in the household. It was also learned that in most cases meals are served first to the children with some favouritism towards boys.

The adult male members were served next and finally whatever remained in the pot was shared by all the adult female members of the family, who in the poor families were often left without breakfast.

The features of food distribution within the household clearly have a cultural basis, and changing this long-standing practice would require a comprehensive educational programme.

3. LIFE STAGES, GENDER AND FERTILITY IN BANGLADESH

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The main purpose of Aziz and Maloney's monograph (1985) was to identify the various life stages of an individual in Bangladeshi culture, to describe the psycho-sexual development and gender role expectations in the different life stages, to relate these issues with sexual and reproductive behaviour, and to suggest implications for policy.

Most of the original field data was gathered by the first author in the course of research conducted in Matlab in 1978. The approach followed was anthropological, with open-ended topical questions about life-histories of 65 male and female respondents.

The respondents selected were all Muslims from five contiguous villages in Matlab Thana. The females selected were in the middle of their child bearing age, 20 to 29 years; the men were 30 to 39 years of age. All had been married once only. Other familial or demographic characteristics of respondents were random.

The method consisted of the following four approaches: 1) respondent's own life-history narration, with emphasis on his or her sex socialization process, in unstructured interviews, covering a total interview time of fourteen hours per respondent; 2) life-histories gathered about the respondent by interviewing other persons, by listening to remarks made about him/her by others, and by examining available documented evidence; 3) observations of the respondent's behaviour and roles related to the topic of investigation; and 4) documented verbal communications concerning the topic between the respondents and their family and peer groups.

The respondents believed that an individual has free will and is accountable for his actions, but also that external factors, such as God's will, Karma, fate, stars, other environmental phenomenon, curses or blessings, foods ingested, and other factors beyond the individual's control are real forces. Although Bangladeshi Muslims believe that they are subdued to a kind of fate which one cannot change by will power, they also believe that they have some kind of control over their current destiny.

Miscarriage and still-birth

When miscarriage or still-birth occur, people usually seek an explanation for the event. As suggested by the following quotations, it is generally accepted that there are causes and reasons behind events, and these causes may operate at several levels simultaneously.

1. Miscarriage is signalled by an excessive discharge of blood. It may result from the evil eye *(kunajar)* of evil spirits *(jin, bhut),* who are very fond of pregnant women. They specially

attack such women if they are thought to have committed any fault. A pregnant woman's movement outside the house should be forbidden during the four critical times of day: dawn, midday, sunset, and midnight, when the evil spirits move freely. Such an attack might affect future births also, so the cure belongs to a magical healer; his success in ridding the woman of the bad spirit is regarded as a great favour from Allah. In this way, the people combine their pre-Islamic and their Islamic beliefs.

2. A miscarriage may result from a curse cast by parents, an elderly person or animal souls on the pregnant women. It may also happen if she crosses the hole of a rat or the bone of a dead cat.

3. Pregnant women wear amulets for protection from fear and shock. To prevent miscarriage, some women make a vow while offering presents to the shrine or the mosque.

4. Miscarriage may take place if a pregnant woman takes any intoxicating drug, strong medicine, or poisonous food.

5. Miscarriage may occur if a woman in advanced pregnancy has coitus with her husband, or if the husband physically abuses his pregnant wife.

6. It is also said that miscarriage or still-birth occur if a pregnant woman eats anything in a dream. This was mentioned by 12 males and 16 females. The reason is that such food might be offered by a spirit with evil design. Another cause of miscarriage or still-birth is believed to be a fall or a blow, apparently accidental but believed to be caused by a supernatural source, or by the touch of an 'inauspicious air' *(alga batash)*. Some respondents also named various evil spirits which they thought caused neonatal tetanus in a newborn child. The most frequently mentioned evil spirit causing neonatal tetanus was *takuria.*

Some of the stated causes of miscarriage and still-birth in the study area are found not only throughout South Asia but also in other Muslim countries as part of popular Islamic beliefs (Sebai, 1974). In all such cases, as in Bangladesh, the cure is by a local healer using both herbs and the invocation of supernatural powers.

Rural Bangladeshis, like all peasant peoples, seek an explanation for unexpected events in life at several levels, such as fate, inherited qualities, the environment, and individual behaviour.

Many people in the study area do not think it is necessary or helpful to seek medical advice during pregnancy. It seems apparent to them that until a child is born it cannot come under a physician's care.

4. COMMUNITY PARTICIPATION IN THE MANAGEMENT OF DIARRHOEAL DISEASES

A monograph by Aziz and Islam (1991) makes reference to socio-cultural dimensions, i.e. cultural values, attitudes, traditions and perceptions, in the management of diarrhoeal diseases, with the objective of considering them when devising new programmes.

Programme implementers need to be aware of the influence of socio-cultural norms on the management of disease at the community level. This is important because communities differ in their structure, perceptions and their readiness to subscribe to innovations.

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Supernatural causes for diarrhoeal illness recur in many cultures (Atanda, 1989; El-Rafie, *et al.*, 1990). Such causes are strongly rooted in the beliefs of the people in these settings, to the point that people are reluctant to question the origin of such beliefs because of the chaos or vacuum in which disbelief would leave them (Black, 1973).

The authors of this monograph have observed the impact on beliefs resulting from the innovative applications of the treatment

of cholera by using intravenous fluids and subsequently by oral rehydration. The striking positive outcome of such treatment in thousands of cholera patients over the years in the Matlab area has effectively jolted the belief in the roles that certain deities and spirits have in bringing about cholera and death in the area.

These roles belong to the goddesses Ola and Kali, both represented in clay images among Hindus, and to the spirit Oba (in Arabic it means 'epidemic') among Muslims.

The Hindus of Matlab no longer specifically worship the goddess Ola and give offerings *(bhog)* to the goddess Kali to be spared from the attack of cholera. The Muslims also do not commission the services of a religious healer any longer to drive away the spirit Oba. Without calling into question the beliefs which do not cause any harm to the affected person, health workers are advised to go ahead with promotional activities related to the prescription of home management of diarrhoeal diseases.

Apart from the findings on the beliefs and practices related to cholera, the authors of this chapter made some empirical observations in the Matlab Diarrhoea Treatment Centre of ICDDR,B, in operation since 1963.

From the beginning until the mid-1980s, many patients irrespective of age and sex were admitted to the Matlab Diarrhoea Treatment Centre with multiple skin punctures, particularly in the fore-arms, with oozing of blood and also with incantated jute string tied around each of their forearms and their necks. The purpose of puncturing the skin was to let out the blood spoiled by cholera.

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The incantated jute strings were put on to free the patient from the possession of the spirit causing the disease. The mothers of breast-fed babies who had cholera also sometimes observed the same practices though they themselves did not suffer from the disease. In the hospital, they were informed about the possible dangers that may arise following skin puncturing and were advised to avoid such practice. Since the mid-1980s the puncturing of skin and wearing of incantated jute strings have no longer been seen.

5. FOOD PREFERENCE AND AVOIDANCE BELIEFS DURING PREGNANCY AND AFTER CHILD-BIRTH

A study was conducted by Islam, *et al.* (1991) among 531 pregnant women between February and April 1982 in the DSS area of Matlab. The women were followed bi-monthly till term and then around the 10th and 45th days postpartum. Interviews based on structured and open-ended questionnaires included information about food preference and avoidance beliefs during pregnancy and after child-birth.

The pregnant and postpartum women stated preference for milk, meat, egg, catfish and climbing perch which are considered prestigious items and are expensive and appealing to the taste. Preferred foods also included oranges, bananas, apples, pineapples, pears, and papaya. These foods are usually costly and hence consumed minimally.

Women expressed avoidance of many foods, including various fish and green leafy vegetables, which are less expensive and easily available, and known as nutritious.

Pregnant women believed that consumption of these preferred foods would give them strength during pregnancy, produce healthy foetuses, and help regain strength lost during labour. The postpartum mothers specially preferred hot spices. These are believed to help in the process of wound healing following delivery.

Some common foods, for example snake-headed fish, sheat fish, *hilsa*, chick-pea, sweet pumpkin and tamarind were avoided both during pregnancy and after delivery for fear of *'sutika'* — a postpartum syndrome characterized by anaemia, diarrhoea, dysentery, dizziness and weight loss.

Sheat fish, eel, green coconut water, wild arum, mutton and duck were avoided by pregnant mothers to protect their newborn babies from acquiring certain undesirable physical or behavioural traits of these animals or plants.

Avoided were also pumpkin leaves, cucumber, chillies, arum, onion, gourd leaves, brinjal, plum, because they are believed to cause rheumatism, anaemia and burning during pregnancy. These foods were also avoided after child-birth for fear of diarrhoeal or stomach problems in the newborn babies through breast-milk.

Food preference and avoidance during pregnancy and the postpartum period, in fact, may greatly limit a woman's actual consumption of food at a time when she should increase her food intake. In the context of rural Bangladesh where both mothers and children have poor nutritional status, nutrition education during pregnancy and the postpartum period should address these issues with due consideration to their sensitive aspects.

6. SOCIO-ECONOMIC DIFFERENTIALS OF DIARRHOEA MORBIDITY AND MORTALITY

Socio-economic differentials in diarrhoea incidence, hospitalization and fatalities were investigated by Islam, *et al.* (1984) in 11 selected villages of Matlab among a population of 15,773.

Four sources of data were used: (1) a prospective study of the impact of hand-pump tube-wells on diarrhoeal episodes; (2) records of hospitalized diarrhoea patients in the Matlab Diarrhoea Treatment Centre; (3) the list of diarrhoea deaths of 1975; and (4) socio-economic and demographic data from a 1974 census (Ruzicka & Chowdhury, 1978).

Socio-economic status, measured by the education of the head of the household, occupation, ownership of household items and dwelling type, showed a significant positive relationship with diarrhoea morbidity. This meant that people of higher socio-economic status reported diarrhoeal episodes more frequently than those of poorer socio-economic status because of better awareness of the disease. Socio-economic status showed a negative relationship with diarrhoea mortality rate.

The relationship between socio-economic status and diarrhoea hospitalization rate was not consistent. Possible differences in the perceptions of the symptoms of the disease in various socio-economic subgroups should be recognized before interpreting these findings.

7. FACTORS AFFECTING CHILD SURVIVAL

A study by Bhuiya (1989) investigated the factors that might affect child survival in Matlab, using the approximate determinants, conceptual framework.

This study used data sets from three sources regarding Matlab villages: (1) a socio-economic survey of 1982 along with the DSS registration data; (2) a survey conducted in late 1986 collecting information in seven selected villages on socio-economic status, nutrition and morbidity for 1,128 children born between 1983 and 1986; (3) a survey among 63 health-care providers from the whole area, conducted during the first half of 1987 to collect information about the way they treat children who are affected by common diseases. Data were collected on mothers' hygiene awareness, behaviour, practices, and knowledge of major childhood diseases and feeding practices. This article highlights information on these aspects only.

A very high degree of awareness about the hazards of drinking unboiled surface water was revealed. Both the maternal education and economic condition of the household were found to be positively related to this awareness. There was a relatively higher level of awareness among the mothers of the MCH-FP intervention area. No significant variation in awareness by maternal age was observed.

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The wearing of amulets is part of everybody's attempts to protect their health and particularly the health of their children.

Village women were initially reluctant to use salt-sugar solutions, until respected members of the community were made part of the programme.

Cartoons are sometimes used for health promotion, as in this case to depict the dangers of indiscriminate use of polluted water.

More than three-quarters of the mothers used tube-well water for drinking. Use of tube-well water was found to be independent of a mother's awareness about the hazards of drinking unboiled surface water, rather it seemed to be the availability of a tube-well which determined its use. A quarter of the mothers reported that they reheated left-over food most of the time before eating. The relationship of this practice was found to be positively associated with a mother's education and the economic condition of the household.

Proportionately fewer mothers from the comparison area reheated foods before eating. The use of soap for hand washing after defaecation or after cleaning a child was not a common practice. The mother's education and the economic condition of the household were the two independent variables found to show significant positive association with the use of soap.

Nearly one third of the mothers related contaminated food and water to diarrhoea, but for dysentery only 2 per cent of the mothers related its cause to contaminated food and water. Most mothers believe that evil eye is the cause of diarrhoea among children. They believe that 'evil eyes' are mostly invisible but they have their effect if they see a child eating. According to mothers, sometimes it is possible for human beings to have 'evil eyes,' and if a child when eating is watched by a person with 'evil eyes', this can cause diarrhoea in the child.

Dysentery was almost always believed to be caused by children eating fish and hot food (or by the mother in the case of a breast-fed child). This may have an adverse influence on child health through avoidance of fish and other nutritious food both by the children and by lactating mothers.

Only 15 per cent of the mothers believed that cutting the umbilical cord with an unsterile instrument might be a cause of tetanus among the newborn; the majority attributed it to an evil spirit. A larger proportion of mothers with some education had scientifically relevant beliefs about the causes of diseases than those without any schooling. More mothers from the MCH-FP intervention villages held scientifically-relevant beliefs than those of the comparison area villages.

With regard to mothers' knowledge about the existence of measles, tetanus, and whooping cough vaccines, it was found that nearly half of the mothers were aware of them. A mother's education and household economic condition were found to be positively correlated with this knowledge. Mothers from the comparison area were always found to have a lower level of knowledge than mothers of the intervention area.

These findings imply that the mothers with some schooling, from economically better-off households, and living in health intervention areas were better informed in terms of hygienic awareness, healthy practices, and knowledge about causes, transmission and immunization of childhood diseases. As a result their children should be less exposed to the risk of contracting diseases, especially of a gastrointestinal nature, and should experience better health and less risk of death. Knowledge about the existence of the immunization programme may mean that there is a greater chance for their children to be immunized, resulting in better chances of survival.

This study showed that apart from breast-milk, rice was the most common food for the children in the study area followed by fish and lentils. Other items like egg, vegetables and meat were very rarely given to the children. There were gender differentials in feeding with rice, fish, vegetables, egg, and meat.

Maternal education was positively related with the frequency of feeding lentils, eggs, and meat. Reduction in the intake of breast-milk and other foods during an episode of illness was also widely observed; however, the reduction was greater in proportion for foods other than breast-milk.

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Half of the sick children had been given some sort of home remedies. Consulting health-care providers for treatment of sick children was not very common. A health-care provider was consulted for one quarter of sickness episodes in children. Half of these providers were allopaths.

More allopathic health-care providers were consulted for male children than for females. The author observed that traditional beliefs prevailing in the community about causes and transmission of diseases may be an important factor deterring parents from approaching scientific or modern methods of treatment and prevention.

Provision of some education for females is expected to lead to a better awareness regarding the prevention and management aspects of many of the common diseases. This may encourage improved hygienic practices and better use of health care services that are available through government, non-government and other community sources.

8. INFLUENCE OF MATERNAL EDUCATION ON INFANT AND CHILD MORTALITY

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Since maternal education has been shown to be an important predictor of childhood mortality in Bangladesh, this anthropological investigation by Lindenbaum, *et al.* (1985) was designed to examine the interacting social and biological variables that had received less attention.

The study focused in particular on the historical shift in the meaning of 'education' in Bangladesh, the psychological and social changes caused by the education of women and the implication that these may have for the survival of infants and children, as well as for women themselves. The study was carried out between mid-February and early May 1983 in four villages of the excluded Matlab DSS area.

The study revealed that educated women may approach child-birth in a relatively better nutritional status than uneducated women, and give birth to babies of greater birth weight, a condition judged to be a survival advantage.

They also may experience greater success in breast feeding, especially if they return to their parental homes for the birth of the first child, a custom many women aspire to, since they expect to be given better food and more rest there.

One further biosocial consequence of women's education may be that, as the study shows, educated women tend to marry into economically "secure" families. In this region, women of economically well-placed families light the hearth fire twice a day for two separate food preparations (apart from breakfast), while in some homes of mid-level social classes and in all of lower social classes they light the fire only once a day (in the late morning).

Thus, the degree of bacterial contamination of food, an important cause of diarrhoeal disease in children, may be greater in families of the poor and less educated who eat foods following longer storage periods.

The authors found no evidence that education significantly changes the ideas of women about the causes of disease. Rich and poor, educated and uneducated, Muslim and Hindu women on the whole share similar beliefs about the origin of disease.

It is only among the most educated women, and only for certain diseases, that one finds different notions concerning disease origin. Some fundamental cultural postulates about the functions of the human body and their relations with the universe still provide a unity from which the causes of specific diseases are deduced.

In conversations at the Shataki study village with 206 persons (155 women and 51 men) concerning the causes of disease, primarily diarrhoeal diseases, fevers and scabies, the germ theory was mentioned only twice.

Among these respondents there was general agreement that infant disorders result from a spirit attack, associated with bad winds, and that illness in all age groups result from various bodily imbalances, caused by poor eating habits, hard work and, occasionally, punishment from God.

In this context, an educated woman's understanding of the value of hygiene and sanitation is an epiphenomenon compared with more fundamental beliefs that explain the workings of the body and of society, as well as the causes of illness.

Educated women follow hygienic behaviour associated with the social standing of prestigious people. They keep their children, children's clothing and food free from dirt and contamination, and observe 'gentleman codes' of personal behaviour. For instance, they refrain from spitting inside houses, wipe mucous from their children's faces and bathe in 'private water'.

The anthropological approach followed in this study treats education as an "empty category", its meaning to be spelled out by informants' opinion, and by observations of day-to-day behaviour of educated and uneducated people in a rural setting.

9. INDIGENOUS BIRTH PRACTICES IN RURAL BANGLADESH AND THEIR IMPLICATIONS FOR A MATERNAL AND CHILD HEALTH PROGRAMME

A report by Bhatia, *et al.* (1979) describes the traditional taboos and practices associated with pregnancy, child-birth and puerperium in the Matlab MCH-FP Project. The practices in some traditional south-east Asian cultures are reviewed and compared with those prevalent in Bangladesh.

The study was conducted in one half of the Matlab DSS project, a village-based programme for the delivery of MCH-FP services which was started in 1977 (Bhatia, *et al.*, 1980).

The material for this study was collected in co-operation with 80 female village workers (FVWs) who were taking in-service training. During the course of their training for delivery of MCH services FVWs were questioned by the authors about the practices and beliefs that exist in this society regarding pregnancy, child-birth, and lactation.

Subsequently, the FVWs were asked to collect information and make notes on indigenous practices of birth attendants, on dietary habits and taboos during pregnancy and the postpartum period, and on nursing and child care in general. The FVWs interviewed 80 pregnant women. Reports were also collected on more than 60 deliveries directly observed by the FVWs. About the same number of postpartum reports were obtained from the FVWs.

When a woman is pregnant, restrictions are imposed upon her diet. The food intake and the kinds of food she eats are strictly controlled by her mother-in-law or by other elderly female relatives. She is advised to eat moderately so that the foetus does not grow too large and make the delivery difficult. She is often forbidden to eat certain kinds of fish, meat, vegetables and sweets. Such foods are taboo because they may harm the foetus or produce certain deformities in the child; or because they might cause a miscarriage.

Once a baby has been delivered, it is laid on the mat and the traditional birth attendant twists the cord around her fingers while waiting for the placenta to be expelled. The cord is not cut until the placenta is delivered. Any delay in the delivery of the placenta is handled by inducing the woman to vomit. To achieve this, the woman's hair is dipped into kerosene oil or garlic paste, and forced down her throat. Sometimes the cord is pierced by a sharp object like a needle or a twig from a broom-stick.

Pulling the cord or trying to extract the placenta manually are other frequently used methods. To tie the cord, a piece of fishnet, a thread pulled from old clothes and entwined to form a thin cord, a piece torn from an old cloth or sewing thread is used. The cord

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is then cut using a sliver of bamboo, or a razor blade; these instruments are rarely boiled before use.

During the postpartum period, women have to practise dietary restrictions. Fish, meat, eggs and spicy dishes are avoided for the first few days; on the fifth day the mother is given a minimum of five dishes to eat which include chicken or fish curry, brinjal chutney, fried banana, pulses and eggs. It is believed that this may bring the child the blessings of five or more dishes all its life.

Restrictions in diet are also observed by lactating mothers and these restrictions become more severe if the child suffers from diarrhoea or has a cold or cough. The foods that are generally avoided are meat, eggs, fish and, occasionally, milk.

Regular breast feeding does not start till after the third day following delivery; in the meantime the child is usually given honey mixed with mustard oil and, occasionally, warm water.

The indigenous practices during pregnancy, child-birth and the postpartum period show that despite a number of good measures to facilitate and ease labour and delivery, certain practices are potentially dangerous and can impair the life of mother or child. Dietary restrictions may deprive pregnant and lactating women of some nutritious ingredients at a time when they may be needed.

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10. PATTERNS OF CHILD FEEDING AND HEALTH-SEEKING BEHAVIOUR

The aim of the study conducted by Zeitlyn and Islam (1989) was to explore the relationship between child survival and mothers' education in order to identify linking mechanisms.

A total of 100 mothers were interviewed in detail.. Half belonged to a village in Chandpur, a rural area neighbouring Matlab, and the other half to Dhaka slums. The rural mothers came from 16 *baris* in a village with a population of 1,937. The majority were the wives of landless labourers or small peasant farmers. They were purposively selected to include 50 per cent who had been to school and 50 per cent who had not.

Most of the mothers worked hard to process rice and undertake other labour-intensive subsistence tasks. A few worked outside their own *baris* in richer households but none received cash payment for their work.

A variety of qualitative research methods were used: 1) intensive interviews, 2) structured observations and 3) extensive participant observation of the community.

The investigators focused on decision-making in relation to nutrition, hygiene behaviour, management of illness in the home and treatment seeking. Some of the findings have been published elsewhere (Zeitlyn & Islam 1991).

The study revealed that people seek help from a variety of different practitioners some of whom use allopathic treatments, some use homeopathic or ayurvedic medicines, and others use holy water or herbs to obtain relief. The latter group, known as *kobiraj*, are the most numerous and are often the first resort for worried parents with children suffering from common disorders, such as diarrhoea or respiratory problems. In many cases it is the proximity of the practitioner and his or her willingness to visit the patient at home, rather than their medicines which make them popular.

It is important to know how people interpret the cause of illness to understand the actions they take. The study investigated the ways people respond to childhood illnesses and tried to show how the definition of illness and the type of healer relate to the moral order underlying social relations.

Diarrhoea:

When a child has bloody and/or mucoid diarrhoea, people tend to think that this is caused by something that has been eaten either

by the sufferer or, in the case of a breast-fed child, by its mother. Lactating mothers all say that they try to avoid certain foods and regulate their diets to balance perceived imbalance in their child's health caused by undue heating or cooling. This relates to a set of ideas that classifies many substances as heating or cooling.

Foods that are classified as "hot", such as beef and hilsa fish, may cause or exacerbate stomach problems, and many think that vegetables are likely to cause diarrhoea. Worms are also believed to be caused by diet and for this reason people say that they would not give too many bananas to small children even if they can afford to buy them.

In Chandpur people identify two kinds of worms: small, known as *kirmy*, and large worms known as *chir*. The latter are believed to be harmful to the body and allopathic remedies are known to be successful in dealing with these.

"Batash" is a common word used to name the un-nameable malign spirits that harm women and children in particular. Sometimes people will say that *batash* is another word for *bhut* or a spirit of the dead, and occasionally people will name a specific agent, or agents, that has caused a child to be ill. When a child has watery diarrhoea *(patla paikhana)* with vomiting, it is thought that he is afflicted by *batash* or that the mother's milk has been spoilt by *batash*. This diagnosis is confirmed if the mother's breasts are full.

This complex of symptoms is known as *dudh haga* (milk diarrhoea). This may have serious implications for the dietary management of illness and the nutritional status of infants and children because mothers respond to this diagnosis by restricting their own diets and reducing the amount of breast-milk.

Other symptoms that confirm the idea that *batash* may be responsible are unusual sleepiness, sunken eyes, changes in body colour or fits. For these reasons tetanus or febrile convulsions may be interpreted as symptoms of *batash* that requires exorcism rather than allopathic remedies.

Respiratory Infections:

When the fever is accompanied by a runny nose or a cough, it is usually associated with cold and in this case, if *batash* is spoken about, it is more in the sense of a cold wind that has chilled the child.

Full breasts, however, may also indicate that the mother should restrict her diet or that her milk has been "spoilt" by *batash.* She may avoid eating rice at night or anything, including cold rice or tube-well water, that is regarded as cooling. The sudden violent winds which blow at certain times of the year are perceived to be destructive to health and have a mysterious and spiritual origin.

The phase of the moon also influences chest disorders, such as pneumonia, asthma, and others. Injuries to the child or to the mother during pregnancy are also commonly cited as causing chest disorders. Certain individuals, such as small children and pregnant women, are particularly vulnerable to *batash.* There are also times that are dangerous for *batash*, so that mid-day and sunset are specially bad times for vulnerable individuals to go out of the *bari.* Women may also try to avoid breast feeding their infants at these times.

If a child suffers from "cold" symptoms that are perceived to be serious and if the parents can afford it, they use allopathic remedies and often will be given a prescription for antibiotics. People understand pneumonia mainly in terms of the sufferer's breathing — its rapidity and the sounds produced in the chest.

Some healers and *kobiraj* in the village claim to know special secret herbs with which they can treat pneumonia. Other treatments involve holy water or "sweeping" the afflicted individual. Some *kobiraj* inherit their knowledge and power from a relative, others from a dream revelation or other spiritual experience.

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The authors categorized as "educated" any mother who claimed to have attended a formal secular school for a period of one year or more. It could be argued that one year's schooling is so minimal that it would make no difference.

They did not find essential differences in the health beliefs or hygiene practices of those who had been to school and those who had not that would explain the well-known relationship between maternal education and child survival. The key differences they found were in kinship patterns and decision-making.

Those mothers who had been to school maintained closer relationships with their own parents after marriage than those who had not been to school. They visited more often and spent longer periods at their natal home. Young children often accompany mothers on these visits and it may be that children benefit from their mothers' supportive kinship network.

Surprisingly they found that in their responses to questions on household decision-making, women who had been to school appear to have less autonomy than their uneducated counterparts. It may be that their responses reflect a greater conformity to dominant social norms.

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11. SEX BIAS IN THE FAMILY ALLOCATION OF FOOD AND HEALTH CARE

The purpose of a study carried out in Matlab by Chen, *et al.* (1981) was to examine the hypothesis that sex-biased health and nutrition behaviour discriminates against female children, which causes higher female childhood mortality.

The study used three sources of data: 1) the birth and death registration data of Matlab DSS for 1974-77; 2) diarrhoeal treatment records of Matlab Diarrhoea Treatment Centre (DTC) for 1977; and 3) morbidity and nutrition data obtained from the Matlab Food and Nutrition Study carried out during 1978-79.

In the first phase of this study during February-March 1978, a baseline survey was conducted in six villages which included 882 children aged less than 5 years. The information collected included household socio-economic status, characteristics of the children, child health history, and maternal and child anthropometric measurements.

In the second phase, a sub-sample of 130 Muslim families with 207 children aged less than 5 years residing in four of the six villages was selected. The selected households had one or more children aged less than 5 years and were easily accessible from the field research station.

The households were grouped into poor, better-off and well-to-do according to household land ownership. Data collected from the households over a one-year period beginning June 1978 included:

1) baseline asset survey and bi-monthly income and expenditure survey,

2) bi-monthly 24-hour measurement of household and individual food intake,

3) monthly anthropometry of mothers and children, and quarterly for all other household members, and 4) weekly morbidity surveillance of children aged less than 5 years.

The study revealed that the proportion of severely and moderately malnourished female children was substantially higher than that of male children.

In-depth dietary surveys showed that males consistently consumed more calories and proteins in all age groups. Despite a nearly comparable incidence of diarrhoeas, male children aged less than 5 years were brought to the Matlab DTC by their guardians far more frequently than female children.

■

CHAPTER 13

Perceptions of Health and Disease in the Matlab Community

Md. Yunus, K.M.A. Aziz & M. Shafiqul Islam

Lessons learned and suggestions for further research

Each culture includes particular ways of thinking, feeling, and responding to health problems that are characteristic of a particular society during a particular period. This paper has presented the Matlab people s perceptions of health problems and their probable solutions, covering a period of over two decades. There have been certain changes in the belief system of the people, particularly with reference to the cause and management of cholera. Further, this paper has pinpointed certain lessons which may be helpful for a more effective implementation of the programme of community management of health problems:

* *It is essential that the health workers in the community, as well as programme heads, are aware of the prevailing health beliefs, so that they are able to make effective communication by categorizing the existing beliefs into innocuous and harmful ones.*

* *In achieving the goal of promoting the modern health care services by way of educational and medical intervention, it is advisable that beneficial and innocuous beliefs are not questioned or challenged by the health workers. Harmful practices are likely to be abandoned by the community itself, if alternative medical interventions are available, easily accessible, and perceived as effective.*

* *Mother s education, even at the elementary level, plays a key role in the development of healthful practices related to disease prevention, and seeking of health services.*

* *There is a need for drastic changes in sex-biased health-related behaviour, including food allocation within the family and use of health services leading to the abandonment of discriminating attitudes against the female child.*

* *Nutrition education during pregnancy and lactation should form a part of the curriculum of primary health workers, traditional birth attendants and midwives. Such education should specially emphasize the low-cost nutritious foods commonly available.*

* *Policy-makers should reconsider the importance of self-management of health in certain specified areas through a proper understanding of the people s perception of health. The lessons learned through this review of different studies on health perception should be taken into account in designing community health programmes.*

Suggestions for Further Research

The review of the studies here has revealed that a wide spectrum of perception of diseases exist which has had a significant influence on the community health behaviour. Centering upon the perception, various issues have emerged which deserve further research:

* *How, by which mechanisms, does elementary education of mothers contribute to the reduction of risk of childhood death?*
* *Is it necessary to explain the germ theory for the causation of disease in rural communities to improve acceptance of modern health care services?*
* *What do educated mothers do differently for disease prevention than those with no education?*
* *What are the roles played by key family members in the management of childhood illness?*
* *How do mothers perceive killer diseases and their management among young children?*
* *What are the people s beliefs about polluted water and food, hygiene, and seasonal changes which are related to the occurrence and spread of diseases?*
* *What are the perceptions of the specific needs of male and female children in terms of food requirement?*

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A Matlab woman leaves the hospital with her children, happier now than when she came in.

CHAPTER 14

Cultural Perceptions about Child Bearing in Matlab

K.M.A. Aziz

Since 1966 scientists at the International Centre for Diarrhoeal Disease Research, Bangladesh (ICDDR,B) in Matlab have been collecting and analyzing data about diarrhoeal diseases, nutrition, maternal and child health, vital events, contraceptive practice and fertility. Despite improvements in community health, the Matlab thana (subdistrict) remains poor, conservative and isolated. Yet there are signs of change, particularly in terms of transport and communication and in the production of high-yielding varieties of paddy.

The study reported in this chapter (Aziz, 1981) was mainly concerned with the understanding of individual fertility behaviour. A holistic approach to the study through in-depth interviews was used. In-depth research on sex socialization in relation to fertility behaviour among the conservative Muslim peasants was quite new in Bangladesh, and a challenging task. The dominant concern with individual fertility behaviour was considered appropriate, bearing in mind the overwhelming population problem in Bangladesh.

The main purpose of the research was to assist in providing necessary scientific information related to social learning about sexuality and fertility which might prove useful in formulating a suitable family planning programme. The view of sex socialization in the study was that it is at the centre of the development of normal human intimacy and affection, and this implies that an individual acts imaginatively in matters of sexual behaviour.

The social, psychological and emotional maturation that occurs during the transitions from childhood to adolescence and from adolescence to adulthood is subject to certain cultural interpretations and reactions.

A society's definition of adulthood is likely to be set in terms of social and cultural tradition rather than of biological maturity. Information about individual fertility behaviour is hard to uncover, and appears to vary according to socio-economic status. In the study area, the effect of sex socialization on fertility remained largely unknown. The cultural or social factors according to which individuals determine their family size needed to be revealed for the various socio-economic levels.

PART III

Philosophies about reproduction and family growth vary from individual to individual. In Bengali culture, some philosophies are present which favour large families, and some which favour small. Such values find expression in practices which influence the interval between births and consequent high or low fertility.

A culture with very scarce resources and relatively crude technology may also have certain practices which contribute towards reducing the population dependent on such resources. Usually these practices involve induced abortion and child neglect.

1. METHODS

The study was carried out during 1977-1980 under the auspices of the Institute of Bangladesh Studies, Rajshahi University. Data was gathered from five villages in Matlab. Life histories were collected from 65 individuals, all of whom had married once only.

There was a balanced representation from both sexes, the age range of male respondents being 30 to 39 years, and that of females being 20 to 29 years. Respondents belonged to the high, middle and low social classes in balanced proportions.

Interviews were carried out between November 1977 and June 1978. In addition to interviews with respondents, there were informal discussions with other individuals, children as well as adults, and behaviours indicative of sex socialization were observed and recorded. The topics of inquiry were mostly unstructured.

The major areas of inquiry included: 1) exposure to sex in the formation of individual philosophies about reproduction and family growth; 2) learning of gender roles; and 3) psychological reasons for procreation.

2. FINDINGS

It was apparent that the parents in the study area who live below subsistence level need children mainly for the continuity of their lineages and old age support. The well-to-do parents not only need children for the continuity of their lineages but also for the protection and inheritance of their property.

2. 1. Clothing

It was found that mothers in the study area clothed their female children earlier than the male children: 15 male and 19 female respondents expressed the need to clothe a female child earlier than a male child. Male-female differences in the perception of such a need was most prominent in the middle class, where the need was expressed by six males and eight females.

If a female infant remained unclothed, the mother, the elder sister or any other female guardian might tell her that her vagina might be taken away by a madman, or that some insects or worms might enter it. These practices indicated greater social concern for the protection of the vagina than for the male sex organ.

Moreover, to protect them from sexual contact, females were often kept confined within the homestead. Symbolic of this confinement was the fact that females were sometimes named after pet birds. In contrast, males were sometimes given names connoting qualities of courage and leadership.

As the female child's breasts and hip developed, the requirements of her clothing gradually became stricter. Four male and six female respondents made statements on such requirements, which might have originated from both social and religious sources. One commentary on the Qur'an (translation: Ali, 1938:904) indicates:

"The rule of modesty applies to men as well as women. A brazen stare by a man at a woman (or even at a man) is a breach of refined manners. Where sex is concerned, modesty is not only 'good form'; it is not only to guard the weaker sex, but also to guard the spiritual good of the stronger sex. The need for modesty is the same in both men and women. But on account of the

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Cultural Perceptions about Child Bearing

differentiation of the sexes in nature, temperaments, and social life, a greater amount of privacy is required for women than for men, especially in the matter of dress and uncovering of the bosom."

It was observed that domestic duties were seen as the realm of women, whereas duties outside the domestic circle were largely the domain of men. In most cases, female participation in productive activities outside the homestead was not permitted by the males. Similarly, females did not expect any assistance from males in most domestic activities.

While working in the field, men wore scanty clothing which was convenient for the performance of their duties: they worked in submerged areas as well as on dry land. Women could not participate in such work as a result of the code of dress, which required them to cover most of their body.

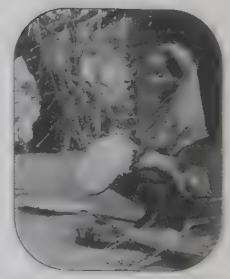
2. 2. Authority and Honour

It was found that a female usually looks for power, authority and honour by bearing more children. Since they performed only household duties, mainly attending to the personal needs of their husbands and children, most women in the study area earned nothing. However, a woman's performance of these tasks helped her sons to become earners, and kept her husband fit for work.

A woman usually had no control over the earnings of her husband and son. However, it was observed that some women with a few earning children were leading a happy conjugal life. In a few cases, women who could draw resources from their parents to add to the household budget commanded authority within the household.

Compared to the male, the personal honour of a female was much more easily threatened. Fourteen males and 17 females said that the female partner in illicit coitus was subjected to more dishonour than the male partner. Consciousness about the loss of honour was found to be greater among the high and middle social classes than in the low social class.

Virtuous women, with a sense of shame, strove to avoid the human contacts which might expose them to dishonour, but they could not be expected to succeed in protecting their honour without the guardianship of males. It was believed that the manliness of a father, brother or husband must be demonstrated in the defence of the honour of the daughter, sister or wife. Failure to do so resulted in disgrace for those concerned.



2. 3. Marriage

In the selection of marriage partners, wealth and earning capacity were most sought after in males, while youth and physical beauty determined the value of the females. A young and physically attractive daughter was thought to need little schooling to become a bride. It was found that the males always preferred to have a wife younger than themselves, this preference fitting well with the traditional guardianship of the husband over the wife. Moreover, the age differences between conjugal partners clearly indicate that it did not matter if the groom was much older than the bride. The rule was that, irrespective of the age of the groom, the bride must be young and well able to physically please her husband.

Most women had no control over the age at which they got married or over the choice of husband. Moreover, brides had no control over the timing of their first pregnancy.

As for the relationship between husband and wife, it was observed that economic responsibility rested entirely on the shoulders of the husband, and he could not demand that his wife become economically productive outside the homestead to help support the family, even if she was capable or desirous of doing so.

Following marriage, a wife would go with her husband to live under his control. A married woman would give priority to her duties towards her husband's parents. The husband was both guardian and support to the wife, protecting her honour and prestige, and providing her with food and shelter.

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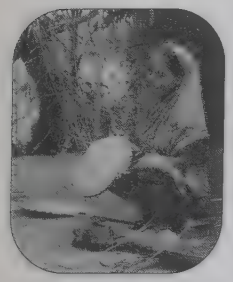
Cultural Perceptions about Child Bearing



In return for this support, a wife had to earn her husband's satisfaction by obeying him, obtaining his permission before going anywhere, and remaining ever ready to fulfill his needs, including his sexual urges.

In the study area, a high degree of sex segregation was practised through the system of *purdah*. *Purdah* limited the contact between male and female outside the controlled environment within the kinship group and usually granted the guardians strict control over the choice of marital partners. These guardians watched, as well as restricted, the movements of women: if women escaped their guardians' control, they could become victims of sexual abuse.

2. 4. Fertility

Restrictions on the movement of women were found to have consequences for fertility behaviour. High fertility is very likely to be affected favourably by factors which limit the women's life to within the domestic circle. Behavioural limitations imposed on the female included such activities as eating, talking, bathing, working and dressing. Family planning policy-makers might consider these restrictions as a negative factor directly influencing the implementation of their programmes.

Until one or more children were born to a newly married wife, there usually remained some doubt about the permanency of the marriage bond. With the birth of a child, the wife became more attentive towards satisfying the needs of her husband because then she felt that the welfare of her child as well as that of herself was tied to the welfare of her husband.

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Cultural Perceptions about Child Bearing

Parental teachings to a married daughter would be given with the objective that she might attain an honourable position in the parents-in-law's house. A wife was expected to exhibit the qualities of patience *(sabur)* and obedience *(badhyayta)*. However, a daughter-in-law could not attain a position of honour by good behaviour only. In addition, she had to bear the required number of children for her husband during adolescence *(nabajauban)* and adulthood *(purna jauban)*.

The traditional behavioural requirements of a daughter-in-law made her dependent on her husband and his family both symbolically and in actuality. In contrast, the son-in-law's prestige, honour and level of acceptance in his parents-in-law's house was not usually determined by his fertility, because traditionally the wife would willingly shoulder the blame for the couple's inability to bear a child or further children in an effort to protect the image of her husband's virility.

The male-female relationship within this cultural context was based on an unequal division of power: not only did the husband completely dominate his wife, but most of his relatives, especially his sisters and parents, wielded varying degrees of authority and influence over her as well.

2. 5. Illegitimate pregnancy

It was found that the mother of an illegitimate child and the child itself were 'objects of disgrace'. For this reason, as soon as an illegitimate child was born, in most cases it faced infanticide. Ten male respondents and twelve female respondents knew of instances of infanticide in the study area.

An illegitimate child usually would be killed immediately after birth, either by the mother herself or by the birth attendant. Birth attendants were mostly close female relatives of the pregnant woman, such as the mother, the sister, the wife of the elder brother, or the paternal or maternal grandmother.

Indeed the birth attendant was deliberately selected from among such close relatives so that the infanticide would not become known to others. The baby was usually killed through suffocation, since suffocation would prevent the baby from crying, and thus those who were not present would remain

A pregnant mother returns home after a one-week stay at the Matlab MCH-FP Clinic. Admission at the clinic often requires that several members of the family also stay to help the

Child-to-child care: it is one of the duties of older children in the Bangladeshi traditional society to take care of their younger siblings. Health education programmes should be targeted at these children.

ignorant of the event. If a child born out of wedlock remained alive, it might soon die as a result of rough handling and neglect.

Koenig, *et al.* (1988) found that during 1976-85 no pregnancies outside wedlock in Matlab resulted in live-births for one of three reasons: abortion of the foetus; death of the mother as a result of abortion; or death of the mother from violence related to the pregnancy.

Another study carried out in Matlab (Fauveau, *et al.*, 1989) showed that, despite the low occurrence of illicit coitus, eight per cent of all maternal deaths take place among unmarried women, three quarters of deaths being among never-married women, and one quarter being among widows or divorcees. Seventy per cent of these deaths result from unsuccessful, clandestine and usually self-induced abortion, while the balance is due to violence, either self-inflicted or from others.

In the study area an illegitimate child faced rejection both by its mother and her close relatives, since the existence of an illegitimate child jeopardized the honour and prestige of the unwed mother and her parents. The cases of infanticide and child neglect showed that honour and prestige were more important than a human life.

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Cultural Perceptions about Child Bearing

The killing of a newborn human baby was not seen as unethical; rather, the established ethical orientation in the study area was a concern about the presence of an illegitimate child, which led to a desire to rid the community of his/her presence.

It appeared that the community did not have the mechanism to accommodate an illegitimate child. It was considered that the traditional values of the community had been disregarded or violated, and this violation was detrimental to the pregnant woman's integrity and value, to the status of the male partner involved, to the honour of the families concerned, and to the well-being of the community itself.

The community elders' judgment on the allegation of illicit conception was usually based on the principles of respect for self and others and the well-being of the community members in general.

2. 6. Fecundity

It was widely believed that high quality seeds must be sown to get a high quality yield. Six male respondents stated this viewpoint, insisting that only healthy parents can procreate healthy offspring.

Three male respondents said that since children are by birth and blood related to their parents, a child of weak parents may be lame, deaf, dumb, or in other ways physically handicapped. Moreover, succeeding generations would be malnourished and susceptible to disease because health at birth has a direct relationship with the semen of the progenitor.

The quality of semen, and therefore a man's ability to produce healthy offspring, was widely believed to be affected by the frequency of coitus, over-frequent coitus with one's wife being thought to make semen thin and less effective.

Eight male and eleven female respondents said that children whose fathers ejaculate excessively are born unhealthy, and remain so as they grow up. Frequent coitus with the aid of contraceptives was also considered harmful.

Perceptions regarding the possible harmful effects of excessive use of semen had led to a belief in the benefits of limited coitus, a belief which might also have come from the practice of abstinence by saintly Muslims and Hindus. Abstinence was in fact advocated by those who thought that it was a more spiritual and therefore superior form of behaviour than gratification of sexual urges. Parents, teachers and religious instructors took the most advantage of this belief, using it as a means to control the behaviour of adolescents.

Others, however, while agreeing that excessive coitus was harmful, considered that total abstinence was not conducive to one's health. With regard to young men and women eight male and eleven female respondents stated that they should have coitus according to their individual appetite.

On the male sex urge several women in the study area stated: "Even though a man is barely alive and hardly able to move, he still does not miss any opportunity to obtain the pleasure of his wife's sexual company".

Another belief regarding semen was that adults have a limited and predetermined quantity, and that a decrease in the supply of semen causes a decline in body strength. Although, according to three male respondents, the supply of semen could be replenished by eating foods of high quality, it was generally believed that the process of replenishment became increasingly difficult as an individual grew older.

The combination of these beliefs described an individual's progress from adulthood through middle age to old age and possible disability. To conserve the health of the aging, and probably also to safeguard the morality of the community, guidelines denoting the proper sexual behaviour of middle-aged and elderly people existed in the study area: "once a month, twelve times a year and reduce to less than that as far as possible..."

On the female sex urge one male respondent stated that after bearing several children, a woman lost interest in coitus. In spite of her reluctance, however, she had to engage in coitus to satisfy the sexual demands of her husband.

Once a marriage is consummated, the woman makes efforts to continue to live with the same husband; since the husband is the provider of food, clothing and shelter, she feels obligated to satisfy his sexual needs.

The woman's interest in sex is submissive and self-sacrificing, but it is believed that she has a better capacity to tolerate suffering without much complaint.

2. 7. Genitality

Genitality was regarded as one of the important aspects of a marital relationship in the study area. Genitality consists of the capacity to develop orgasmic ability, which involves more than simple ejaculation or lubrication. It combines the ripening of intimate sexuality with full genital sensitivity and with a capacity to discharge tension from the whole body. When in the study area either partner of the couple failed to discharge such "body tension", then he or she was considered to be impotent.

Since the procreative function of marriage was heavily stressed in the study area, impotent males usually did not marry. Under the Dissolution of Muslim Marriage Act of 1939, a woman married under Muslim Law was entitled to obtain a decree for the dissolution of her marriage on the grounds that her husband had been impotent since the beginning of their marriage.

Infertility in the case of females, however, could not be diagnosed until it was tested through marriage. Following marriage, if the woman failed to bear offspring despite sufficient efforts, her husband would sometimes marry a second wife for the purpose of procreation. If the second wife bore a child, then the infertility of the first wife would be confirmed.

2. 8. Family size

In the study area the majority of the parents and their married children shared a favourable attitude towards small family size. With regard to their focus group investigation carried out in 1986, Duza and Nag (1988) reported that the desire to limit family size was essentially aspiration-driven, a reaction to the new society and economy and to the opportunities they offer. However, elderly

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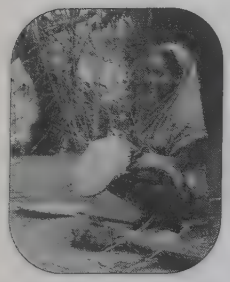
Cultural Perceptions about Child Bearing



members of the family who did not approve of family planning methods believed that it was more important to have a large family, since many children could earn more money for the family. Several males and females of the study area stated that if five sons went fishing, the catch would be five times higher than one son's catch.

2. 9. Communication within the couple

It was observed that traditional practices tended to work against communication within a married couple. Since almost all marriages were arranged, partners had no romantic involvement prior to marriage. Once married the husband and wife were not expected to talk to each other in the presence of their elders.

It is, therefore, perhaps no wonder that Gore (1968) showed that husbands in rural India felt closer to their mothers than to their wives. This is also in keeping with the Islamic tradition prevalent among the Matlab people according to which a son must always consider his mother as more important than his wife.

Moreover, informal discussion with some males in the study area revealed that a couple's verbal communication in bed often ceased when the children reached eight or more years of age and were likely to have gained a little knowledge of human sexuality. Fearing that their children might hear their conversation and thus guess at their sexual relations, the parents refrained from talking altogether during love play and coitus.

Under such circumstances it required a time-consuming effort on the part of husband and wife to develop sufficient communication to talk about the issue of family planning. Furthermore, if there was a difference of opinion between the husband and wife, the opinion of the husband usually prevailed.

When asked about their future plans for more children, most of the young wives with few children gave a smile indicating their shyness at being questioned about such a very personal subject. When pressed to give their plans, they usually replied: "It is not my business, it depends on my husband's wishes."

Quoting Gandhi from the work of Prabhu and Rao, Chandrasekhar (1955) notes:

"I have felt that during the years still left to me, if I can drive home to women's minds the truth that they are free, we will have no birth control problem in India. If they will only learn to say 'no' to the husbands when they approach them carnally ... the real problem is that they do not want to resist them."

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Cultural Perceptions about Child Bearing

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2. 10. Late pregnancies

When a husband and wife became grandparents, they assumed the role of guardians, and thus felt ashamed if they had any subsequent children themselves. Following such a birth, people around them would think that in spite of their age, this couple had continued to remain sexually active. The grandchildren would ridicule their grandparents' sexual life.

It would become difficult to keep discipline in the sexual conduct of grown unmarried offspring if their parents themselves remained sexually active. It was considered better for all offspring to remain unaware of the sexual relations between their parents.

If the mother of a sexually mature unmarried son or daughter became pregnant, then it was only reasonable to arrange marriage for that son or daughter so that they also could find opportunities to have coitus with their legal sexual partners.

It was observed that when the wife reached middle adulthood, she and her husband usually no longer wished to have more children.

This observation is corroborated by data on the age-specific birth rate in Matlab (Ruzicka & Chowdhury, 1978), which showed that there was a significant fall in births when women moved from age group 30-34 years to age group 35-39 years.

It was found that 19 per cent of women aged 30-34 years gave birth compared with 8 per cent in the age group 35-39 years and only 2 per cent in the age group 40-44 years.

These differences in age-specific fertility may result from differential biological potentials as well as cultural constraints related to increased age. Another observation consistent with the above findings is the notable peak of abortions (and abortion-related deaths) reported in the Matlab area at ages 35 to 40, all among married women (Fauveau & Blanchet, 1989).

The feeling of shame which a couple who had grandchildren experienced at the birth of another child arose neither from a desire to limit population growth nor from Islamic instruction.

The Quran (trans.:Ali 1938) states:

Your wives are as a tilth unto you;
So approach your tilth when or how you will.

Rather, this shame arose from the sex socialization process probably intended to impose a psychological restraint on the sex conduct of the people. It was probably more as a means of controlling behaviour than of limiting the birth rate.

In his commentary on the above passage from the Quran, Ali (trans.: 1938) states:

"Sex is not a thing to be ashamed of, or to be treated lightly, or to be indulged to excess. It is solemn a fact as any in life. It is compared to a husbandman's tilth; it is a serious affair to him: he sows the seed in order to reap the harvest. But he chooses his own time and mode of cultivation. He does not sow out of season nor cultivate in a manner which will injure or exhaust the soil. He is wise and considerate and does not run riot. Coming from the human beings, every kind of mutual consideration is required, but above all, we must remember that even in these matters there is a spiritual aspect. We must never forget our souls, and that we are responsible to God."

■

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Cultural Perceptions about Child Bearing

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Cultural Perceptions about Child Bearing

Over the years, the reluctance to travel to Matlab for maternal and child care has dissipated and many women turn to Matlab in times of need.

CHAPTER 15

Contraceptive Use in Matlab in 1990: Levels, Trends and Explanations

Michael A. Koenig
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Mehrab A. Khan
J. Chakraborty
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Since its inception in 1977, the achievements of the Matlab maternal and child health/family planning (MCH-FP) project in rural Bangladesh have been documented in a series of detailed research studies. Some of these studies have focused on the impact of the family planning programme upon contraceptive use and fertility.

Others studies have explored the impact of the Project's health and family planning interventions upon maternal and childhood mortality. A third set of studies have investigated the lessons that have emerged from the Matlab programme for effective health and family planning service delivery in Bangladesh and for other settings characterized by unfavourable socio-economic conditions.

In this article, the impact of the Matlab family planning programme upon contraceptive behaviour is explored. Although the rise in contraceptive prevalence in the Matlab intervention area in the initial years of the programme has been well documented, relatively less is known about more recent trends and patterns.

The results of a survey of knowledge, attitudes, and practice (KAP) of family planning carried out in the Matlab intervention and comparison areas during 1990 provide an opportunity to describe recent changes in contraceptive use. Explanations are considered for the observed differences in family planning performance between the two areas.

1. SETTING AND DATA

In October 1977, the International Centre for Diarrhoeal Disease Research, Bangladesh (ICDDR,B) launched an experimental MCH-FP programme in its rural study area in Matlab, which consisted at that time of 149 villages with a total population of 180,000. The project was introduced to test the hypothesis that demographic change could be induced and sustained through an intensive service-delivery programme, even in the absence of extensive socio-economic development. The project was based upon an experimental design

PART III

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wherein half of the villages in the study area (the intervention area) received intensive services delivered by the ICDDR,B, while the other half (the comparison area) continued to receive only the more limited services provided by the government programme (the differences between the two programmes are described in Koblinsky, *et al.*, 1984).

Although the programme began with a primary emphasis on family planning and only a limited focus on MCH services, over time additional MCH components have been integrated into the service programme. These components included oral rehydration therapy and maternal tetanus immunization in the late 1970s, and measles immunization, training of traditional birth attendants, and antenatal care in late 1982 (Phillips, *et al.*, 1984b; DeGraff, *et al.*, 1986).

From the mid-1980s onwards, the pace of introduction of additional MCH components was intensified. By 1990 the full DPT vaccination series for children, vitamin A supplementation, curative outreach services for acute respiratory infection and dysentery, child nutrition rehabilitation services, and maternity care had also been added to the service programme (Fauveau, *et al.*, 1990).

In the intervention area, data on contraceptive prevalence and immunization coverage are routinely collected through a computerized system of monthly service statistics. No similar monitoring system exists in the comparison area, and the only recent information on health or family planning comes from a KAP survey conducted in both areas in 1984.

CONTINUED...

Contraceptive Use in Matlab in 1990

A central objective of the 1990 KAP survey was, therefore, to provide updated information on family planning and MCH service performance in the comparison area. In the intervention area, it was of interest to obtain similar information from an independent source of data unrelated to the service programme.

The second objective of the survey was to provide detailed information on the factors responsible for the observed differences between the two areas in contraceptive use levels.

The KAP survey was introduced in the Matlab study area in early 1990. At that time the Matlab study area consisted of 142 villages with a population of approximately 200,000.

Multi-stage sampling procedures were employed to yield a sample of approximately 8,500 currently married women of reproductive age, with about equal numbers of respondents from each area. Doing so led to the random selection of 31 villages in the intervention area and 36 villages in the comparison area during the initial stage.

A sampling frame was constructed based upon a census-type enumeration of all respondents in the selected villages. In the intervention area, this was straightforward, since a computerized service record-keeping system provided an accurate and up-to-date list of all eligible women residing in the villages.

In the comparison area, where no such system was maintained, a household enumeration of all currently married women of reproductive age (aged 15 to 49 years) resident in the 36 selected villages was required, to supplement information available from the Matlab Demographic Surveillance System through December 1988. Upon the construction of the sampling frame in both areas, every other eligible woman was selected for inclusion in the sample.

The women's overall response rates were high, approaching or exceeding 90 per cent in both areas. Non-response was mainly due to absence from the home; refusal to be interviewed was rare.

The total numbers of respondents interviewed in the intervention and comparison areas were 4,238 and 3,708, respectively. Field

work was initiated in January 1990 and completed by July 1990. The interviews were conducted by 12 women and four men, all of whom had extensive previous experience with family planning surveys and were unaffiliated with the service programme in the intervention area. These interviewers were supervised by two field managers based at the Matlab station.

In analysing trends over time, the results of the 1990 KAP survey are supplemented with data from previous surveys carried out in the Matlab study area (Koenig, *et al.*, 1987). These include a 1984 KAP survey of 6,214 women of reproductive age (3,785 and 2,429 respondents in the Matlab intervention and comparison areas, respectively) that was used to collect similar information on the respondents' knowledge of, attitudes about, and practice of, family planning.

Data from a 1977 baseline enumeration of 15,672 currently married women of child-bearing age, limited to the intervention area at the start of the service programme, are also considered.

A third source of data is a survey undertaken in 1975 as part of the Contraceptive Distribution Project (CDP) that antedated the current Matlab programme. The CDP survey yielded a total of 269 and 238 interviews with married women of reproductive age from what are now the intervention and comparison areas.

2. RESULTS

2. 1. Contraceptive use levels

Table 1 (overleaf) shows survey results for current contraceptive use levels for the Matlab intervention and comparison areas for all currently married women aged 15 to 49 years. By 1990 contraceptive prevalence had reached 57 per cent in the intervention area.

Modern methods accounted for almost all contraceptive use (94 per cent), with injectable contraceptives being the method of choice for 50 per cent of users, followed by pills (21 per cent), and female sterilization (15 per cent).

Contraceptive use in the comparison area was significantly lower, 27 per cent, a difference of 30 percentage points. The comparison area had a very different method profile from the intervention area: female sterilization was the most popular method (35 per cent of all methods used), followed by the pill (30 per cent), and traditional methods (26 per cent).

Consideration of only modern contraceptive methods leads to an even larger differential in prevalence between areas: 54 per cent used them in the intervention area versus 20 per cent in the comparison area.

Women who express a desire for no more children may be considered to be potential users of family planning for the purposes of limiting family size, while those who want more children may be considered potential family planning spacers.

Table 2 (overleaf) shows that significant differences existed between the two areas in the proportions of women using contraception for spacing and limiting births. Seventy-one per cent of potential limiters in the intervention area, in contrast to only 37 per cent in the comparison area, were practising contraception in 1990.

While a sizable proportion (42 per cent) of women in the intervention area also reported the use of contraceptives for spacing, in the comparison area such use was not widespread (15 per cent). A decomposition of the difference in contraceptive-use levels between the two areas in 1990 indicates that both limiting and spacing contributed to the higher contraceptive prevalence level in the intervention area. Greater use among limiters accounted for almost two thirds (66 per cent) of this difference, while higher use levels among spacers accounted for 38 per cent of the difference (the higher proportion of women in the comparison area who wanted no more children reduced this differential slightly).

CONTINUED

Contraceptive Use in Matlab in 1990

TABLE 1

Percentage distribution of currently married women aged 15-49 who are practicing contraception, by method, Matlab study areas, 1990

Variable	Intervention area		Comparison area	
	%	(N)	%	(N)
Current nonuser	42.9	(1,820)	72.8	(2,699)
Current user	57.1	(2,418)	27.2	(1,009)
Modern methods				
Female sterilization	14.8	(359)	34.8	(359)
Vasectomy	0.7	(15)	0.9	(9)
IUD	6.2	(150)	2.4	(24)
Injectable	49.8	(1,205)	4.1	(41)
Pills	21.1	(511)	29.9	(302)
Condom	1.4	(34)	1.5	(15)
Foam/Jelly	0.2	(5)	0.4	(4)
Subtotal	94.2	(2,279)	74.0	(746)
Traditional methods				
Rhythm	2.6	(64)	13.5	(136)
Kobiraji[a]	1.7	(42)	7.6	(77)
Withdrawal	1.4	(33)	4.6	(47)
Other	0.0	(0)	0.3	(3)
Subtotal	5.7	(139)	26.0	(263)
Total	**100.0[b]**	**(4,238)**	**100.0**	**(3,708)**

[a]Traditional herbal medicine. [b]Total is less than 100% because of rounding

CONTINUED...
Contraceptive Use in Matlab in 1990

TABLE 2

Trend in the percentage of currently married women aged 15-49 who practice contraception, by their desire to limit or to space children, Matlab study areas, 1977, 1984, and 1990

Desire for children	Intervention area			Comparison area	
Desire for children	**1977**	**1984**	**1990**	**1984**	**1990**
All women	19.0	38.2	57.6	15.8	27.9
(N)	(13,594)	(3,123)	(4,181)	(1,966)	(3,613)
Women who:					
Do not want more children	42.1	(48.2)	70.7	24.0	37.1
(N)	(4,810)	(1,716)	(2,270)	(1,148)	(2,102)
Want more children	6.3	26.0	42.2	4.4	15.0
(N)	(8,784)	(1,407)	(1,911)	(818)	(1,511)

Note: Excludes women who gave non-numerical responses to the question of additional children desired in each of the surveys. Data for the comparison area are not available for 1977.

Table 3 (overleaf) presents data on contraceptive-use levels by selected demographic and socio-economic characteristics. As would be expected, contraceptive-use levels among women in the intervention area were positively associated with maternal age, number of living children (up to four) and number of living sons (up to two). Although few women practise contraception prior to the birth of their first child (7 per cent), more than one-quarter of the women with no living sons (28 per cent) were doing so, a surprising finding in light of the strong preference for sons that characterizes this society (Ahmed, 1981; Cleland, *et al.*, 1983). Although much smaller in magnitude, differentials in contraceptive use by demographic characteristics were also evident in the comparison area. On the whole, the greater propensity to practise contraception in the intervention area was maintained in all subgroups.

By 1990 use of contraceptives within the intervention area had diffused so widely that differentials in use by the mother's educational level were no longer evident (see Table 3); 58 per cent of uneducated and 59 per cent of more educated women (8+ years of schooling) reported that they were currently practising contraception. In the comparison area, modest but consistent differentials in contraceptive-use levels by women's educational status were evident, although use levels remained substantially lower than in the intervention area among all educational subgroups.

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Contraceptive Use in Matlab in 1990

2. 2. Trends over Time

Data on trends in current contraceptive use by preferences for additional children are also presented in Table 2. The significant increase in contraceptive use in the intervention area between

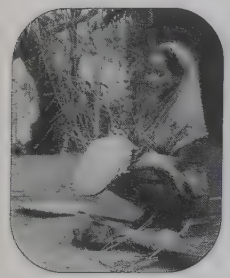

TABLE 3

Percentage of currently married women aged 15-49 who practice contraception, by selected demographic variables, Matlab study areas, 1990

Variable	Intervention area		Comparison area	
	%	(N)	%	(N)
All women	57.1	(4,238)	27.2	(3,708)
Maternal age				
<20	23.2	(181)	5.3	(189)
20-29	46.0	(1,870)	19.1	(1,693)
30-39	67.0	(1,371)	35.8	(1,146)
40+	73.2	(816)	39.0	(680)
No. of living children				
0	6.9	(333)	3.1	(322)
1	40.1	(724)	14.0	(578)
2	55.5	(803)	20.7	(610)
3	63.9	(812)	33.2	(674)
4	73.8	(733)	36.3	(612)
5	73.1	(461)	39.9	(461)
6+	70.4	(372)	35.9	(451)
No. of living sons				
0	27.8	(958)	9.4	(842)
1	54.4	(1,270)	22.3	(993)
2	72.3	(1,091)	38.8	(881)
3+	73.1	(919)	37.0	(992)
Maternal education				
No education	57.9	(2,553)	24.5	(2,385)
1-7 years	55.9	(1,465)	30.6	(1,137)
8+ year	59.1	(220)	40.9	(186)

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Contraceptive Use in Matlab in 1990

1977 and 1984 was documented in a previous paper (Koenig, *et al.*, 1987).

A further sharp increase in contraceptive use was evident between 1984 and 1990, with prevalence in the intervention area increasing by 20 percentage points during this period (from 38 per cent to 58 per cent).

A significant increase in contraceptive prevalence for birth-spacing purposes was also evident in the same area between 1984 and 1990 (from 26 per cent to 42 per cent), continuing the earlier trend during 1977-84.

In contrast to the 1977-84 period, however, when the proportion of women in the intervention area practising contraception to limit family size increased only modestly (from 42 per cent to 48 per cent), a significant increase in use was registered over the 1984-90 period. By 1990 the proportion of potential limiters who were currently using contraceptives had risen to more than 70 per cent.

The decomposition of the increase in contraceptive use between 1984 and 1990 shows that increased use among limiters accounted for 57 per cent of the overall rise. The contribution of increased use among spacers was also significant, accounting for 43 per cent of the rise. The effect of changes in fertility preferences during this period was negligible.

In the comparison area, significant increases in contraceptive use for both spacing births (from 4 per cent to 15 per cent) and limiting family size (from 24 per cent to 37 per cent) were also registered between 1984 and 1990.

Figure 1 (right) shows the contributions of specific methods of contraception to the observed changes in contraceptive prevalence in the intervention and comparison areas during the 1977-90 period. In the intervention area, most of the increase in contraceptive use between 1977 and 1984 was accounted for by increased reliance upon injectables, female sterilization, and the IUD.

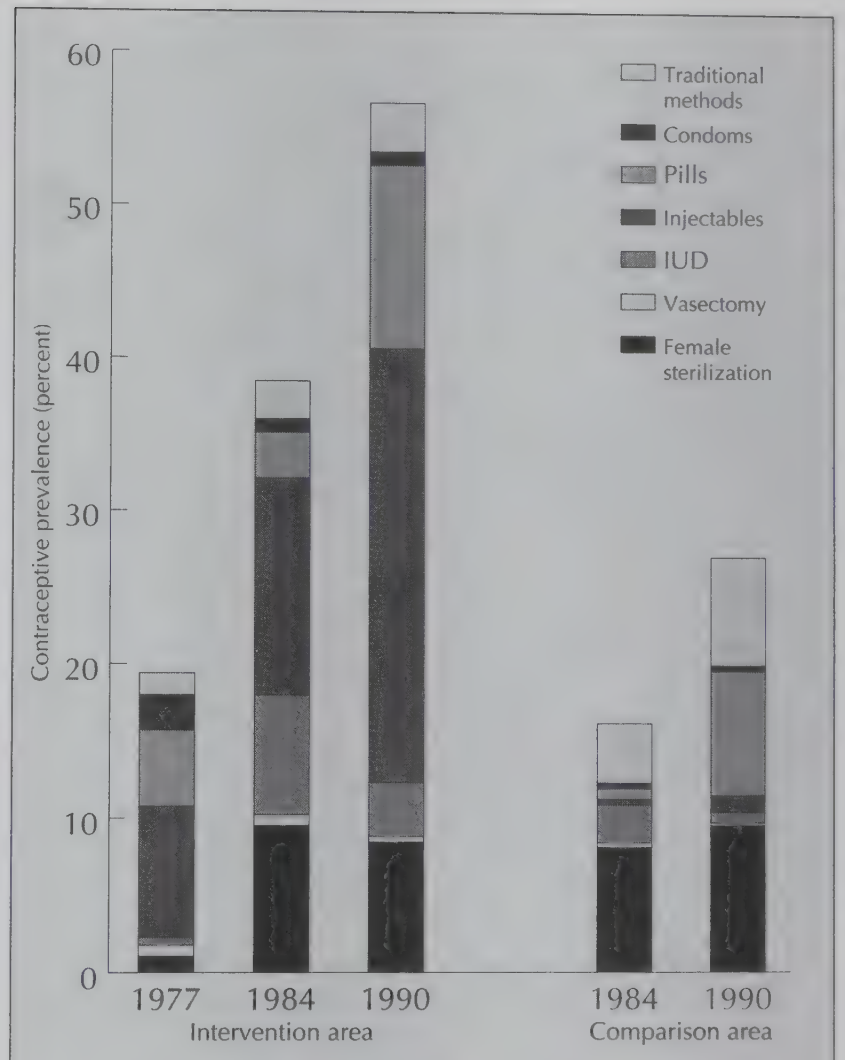

Fig 1 : Trends in contraceptive method mix in the Matlab study areas, 1977-1990

Note: Data for the comparison area are not available for 1977.

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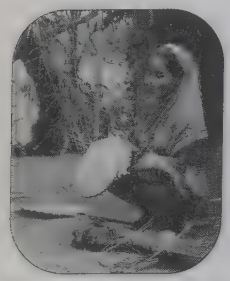
Contraceptive Use in Matlab in 1990



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Contraceptive Use in Matlab in 1990

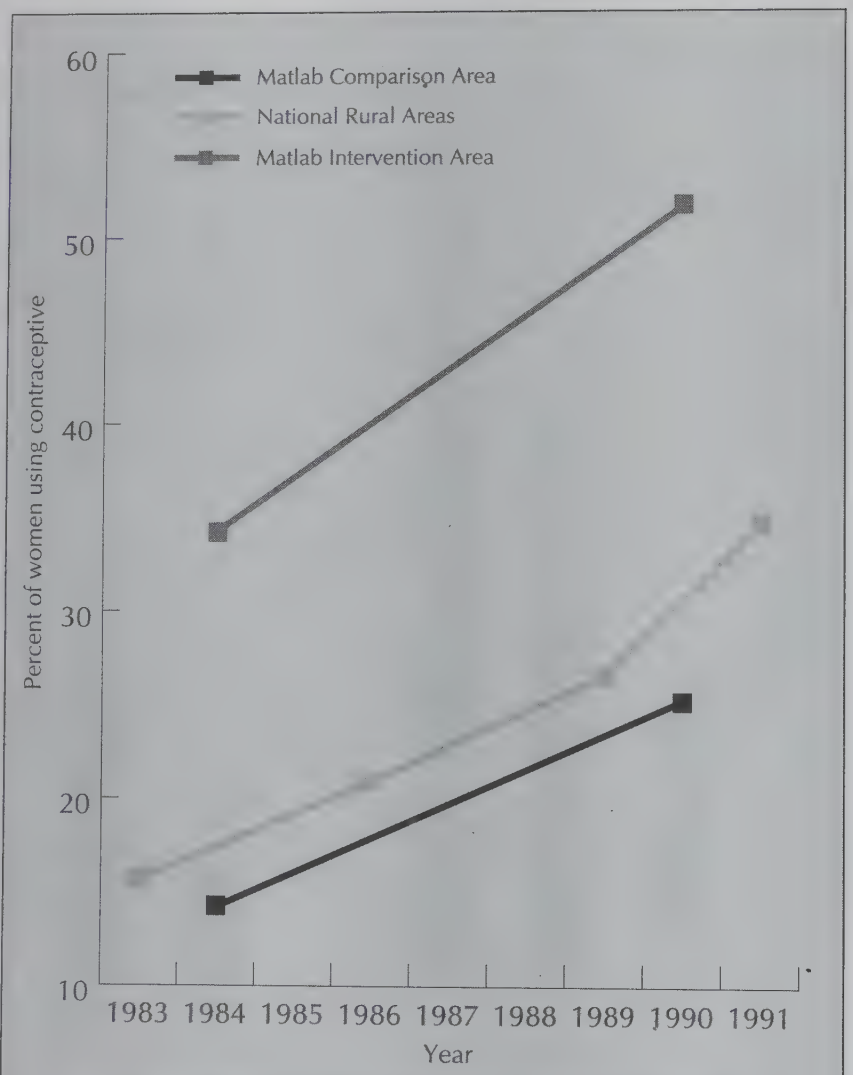

Fig 2 : Trends in contraceptive use in Matlab and rural Bangladesh, 1983-91

sources: Mitra et al. (1992); Koenig et al. (1987)

Between 1984 and 1990 the rise in overall contraceptive use was largely attributable to an increase in the use of injectables and the pill; both methods are provided on an outreach basis in the Matlab programme, greatly facilitating access.

Use of the clinical methods of female sterilization and the IUD declined somewhat during this period. The decline in female-sterilization prevalence can be explained by the ICDDR,B decision to terminate its sterilization programme in 1985, leaving the government programme as the only source of sterilization services. A number of cases with complications were reported during the subsequent period. The reasons behind the decline in the popularity of the IUD in the Matlab area after 1984 remain unclear, but there were also several reports of complications.

In the comparison area between 1984 and 1990, use of oral contraceptives accounted for most of the increase and, to a lesser extent, traditional methods of contraception also increased. Figure 1 also illustrates that temporary methods of contraception account for the higher rate of contraceptive prevalence in the intervention area; sterilization prevalence remained similar in the two areas.

Table 4 (facing page) shows contraceptive-use trends over time for the Matlab intervention and comparison areas, by selected demographic characteristics. With the exception of women who were younger than 20 years of age and those who had no living children, substantial increases in use were evident among almost all of the demographic subgroups between 1984 and 1990. Similar increases were also evident in the comparison area during this period, although they were generally much smaller.

Recent trends in contraceptive prevalence in both areas of Matlab and in rural Bangladesh as a whole over the 1983-91 period are shown in Figure 2 (left). Two main findings emerge from these trends: 1) although contraceptive-use levels in the Matlab intervention area remain much higher than the national rural average, consistent increases in use have also been registered for

TABLE 4

Trends in current contraceptive use among women aged 15-49, by selected demographic variables, Matlab study areas, 1977-90

Variable	Intervention area						Comparison			
	1977		1984		1990		1984		1990	
	%	(N)	%	(N)	%	(N)	%	(N)	%	(N)
Total	18.7	(13,846)	38.1	(3,137)	57.1	(4,238)	15.8	(1,972)	27.2	(3,708)
Mother's age										
<20	5.6		24.5		23.2		2.8		5.3	
20-29	16.4		30.4		46.0		10.6		19.1	
30-39	28.7		46.7		67.0		22.2		35.8	
40+	28.4		45.1		73.2		20.7		39.0	
No. of living children										
0	2.4		3.4		6.9		0.0		3.1	
1	9.6		23.2		40.1		3.8		14.0	
2	14.3		32.3		55.5		9.7		20.7	
3	21.9		41.7		63.6		15.5		33.2	
4	26.4		49.9		72.1		22.9		36.3	
5	31.0		47.9		76.2		26.0		39.9	
6+	33.4		46.6		70.0		22.4		35.9	
No. of living sons										
0	5.2		16.7		27.8		2.9		9.4	
1	16.3		35.0		54.4		11.6		22.3	
2	27.4		49.3		72.3		20.0		38.8	
3+	31.9		45.3		73.1		24.6		37.0	

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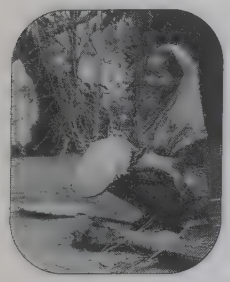
Contraceptive Use in Matlab in 1990



Bangladesh as a whole during this period; and 2) contraceptive-use levels in the comparison area were no higher, and were in fact somewhat lower, than the reported national rural levels during this period. A plausible explanation is that the Matlab study area lies in the Chittagong Division, one of the most conservative and least developed regions of Bangladesh, and one in which contraceptive-use levels have consistently lagged behind other areas of Bangladesh. In 1991 contraceptive prevalence in the rural areas of the Chittagong Division was 27 per cent, compared with more than 40 per cent in the other three divisions.

There was a reduction of 29 per cent in the total fertility rate in the intervention area from 5.1 per cent in 1980 to 3.6 in 1990 (see Table 5, below). A more modest decline (22 per cent) in the total fertility rate is evident in the comparison area, a reduction from the 1980 level of 6.7 to 5.2 in 1990. Fertility levels in the intervention area remained almost one-third lower than that in the comparison area in 1990 (31 per cent).

TABLE 5

Total fertility rates in Matlab study areas, 1980-90

Study area	1980	1985	1990
Intervention area	5.1	4.5	3.6
Comparison area	6.7	6.0	5.2

Source: ICDDR,B (1992).

CONTINUED...
Contraceptive Use in Matlab in 1990

3. EXPLANATIONS

Four explanations have been advanced for the high levels of contraceptive prevalence in the Matlab intervention area:

1) the special nature of the Matlab study area;

2) socio-economic differences between areas;

3) differences between the two areas in the demand for family planning; and

4) differences in their service-delivery programmes.

In the following discussion, we consider evidence bearing on each of these possible explanations.

3. 1. The Special Nature of the Matlab Study Area

One frequently voiced explanation for the high levels of contraceptive use in the Matlab study area is that this area may be increasingly unrepresentative of conditions prevailing in rural Bangladesh as a whole.

According to this view, the presence of ICDDR,B during the last three decades and the resources invested in the area during this period have contributed to modernization and improvements in socio-economic conditions that make the area unique in rural Bangladesh (Phillips, *et al.*, 1988).

The presence of ICDDR,B may have transformed an isolated, traditional population into one linked to the outside world, exposing it to modernizing influences and new ideas, including those pertaining to family size and fertility control.

In addition, the considerable employment opportunities generated by the presence of ICDDR,B have contributed significantly to improvements in the standard of living and health conditions. Together these changes have created a better environment for smaller families and for the interest in and practice of fertility control.

Available data on education and health conditions, however,

provide only limited support for this view. Results from the 1990 survey show that in the Matlab study area, 62 per cent of adult women are uneducated, compared with 67 per cent of all rural Bangladeshi women as reported in a recent national survey (Mitra, *et al.*, 1992).

The proportions of women who could be considered more educated (8+ years of schooling) are also low in both Matlab and in rural Bangladesh overall (fewer than 5 per cent).There is also little evidence that health conditions in the Matlab study area are significantly better than in other areas of rural Bangladesh.

Despite some progress in reducing childhood mortality levels, especially in the intervention area (see Figure 3, below), mortality levels continue to remain high by international standards in the study area as a whole. Data from nine rural areas of Bangladesh also indicate that the prevalence of malnutrition and diarrhoeal disease was not lower in Matlab than in the other areas surveyed (Bloem, *et al.*, 1990).

An explanation for this may lie in the relatively more difficult socio-economic conditions of that part of Bangladesh in which the Matlab study area lies. In addition, such ICDDR,B interventions as those related to diarrhoea have been largely curative, rather than preventive, in nature.

Undoubtedly the strongest evidence arguing against this explanation comes from the experimental design of the Matlab project itself: The arguments outlined above should apply in equal

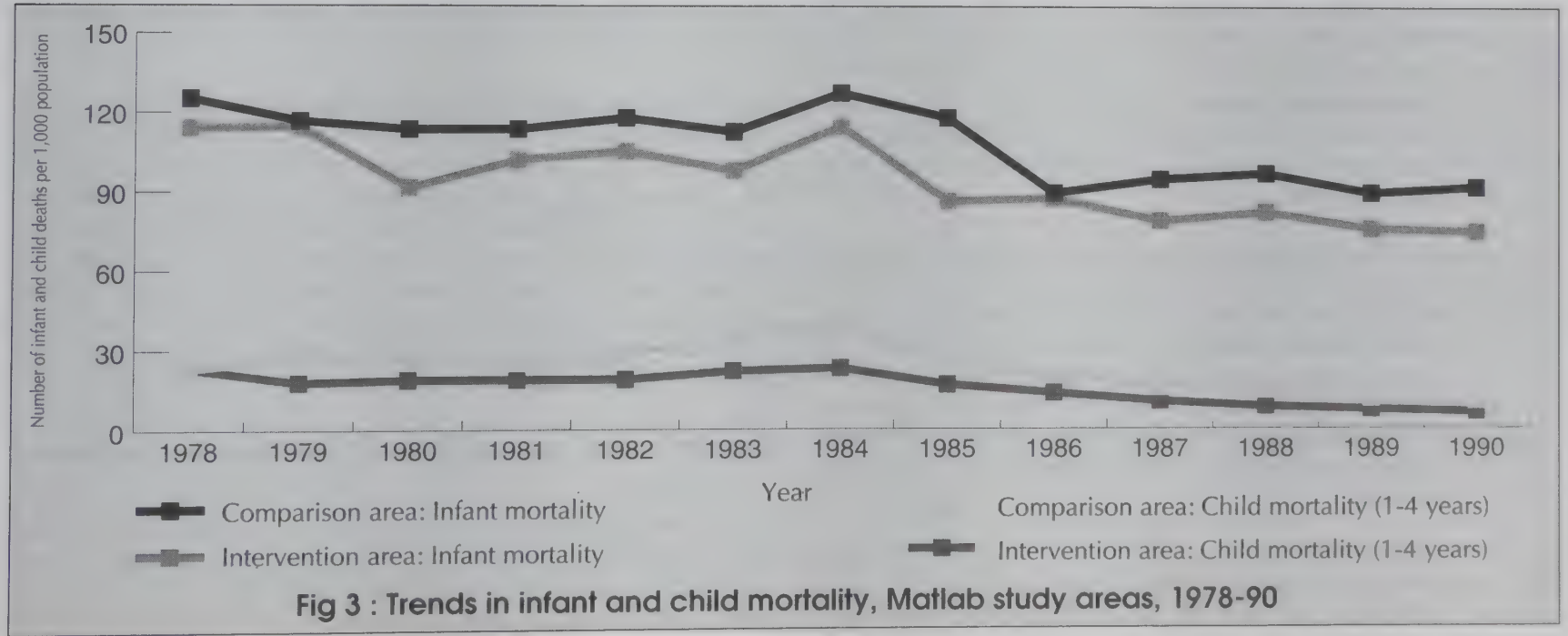


Fig 3 : Trends in infant and child mortality, Matlab study areas, 1978-90

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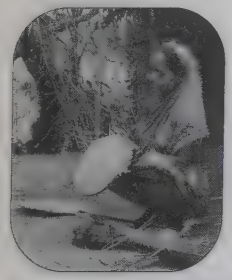
Contraceptive Use in Matlab in 1990



force to both the intervention and the comparison areas, yet high levels of contraceptive use remain limited to the intervention area.

Contraceptive prevalence in the comparison area is slightly lower than levels found in the rest of rural Bangladesh. Therefore, explanations must be developed for the differential contraceptive performance of the intervention area relative to the comparison area.

3. 2. Differences Between Areas in Socio-economic Conditions

The success of family planning in the intervention area relative to the comparison area is often explained by differences in levels of socio-economic development. According to available data, however, living standards are not appreciably different.

Only slightly higher levels of education and literacy are evident in the intervention area (5.2 per cent of women in the intervention area have had more than eight years of schooling, compared with 5 per cent in the comparison area; literacy rates are 32.1 per cent and 28.7 per cent, respectively). The low levels of female education and literacy that prevail throughout the Matlab study area are more relevant findings.

The results shown earlier in Table 3 also bear directly on this issue. The intervention area differentials in contraceptive use by educational status had disappeared by 1990. Thus, even if there were differences in educational levels between the two areas, the absence of educational differentials in contraceptive use rules out this factor as an explanation for the observed differences in contraceptive prevalence. Other indicators of socio-economic status, such as dwelling size, also indicate few differences between the areas.

Trends in infant and child mortality in the Matlab intervention and comparison areas over the 1978-90 period are also shown in Figure 3. Although the comparison area has been characterized by higher levels of infant mortality, the differential between areas has remained relatively constant throughout the project period.

While steady declines in infant mortality levels have been evident in the Matlab area from the mid-1980s onwards, parallel declines have occurred in both the treatment and comparison areas. One explanation for the decline in infant mortality levels in the comparison area has been high immunization coverage with maternal tetanus toxoid since the mid-1980s.

The comparison area has also been characterized by higher mortality levels for children from one to four years old throughout the study period. While sharp declines in mortality for those ages have also taken place in both areas since the mid-1980s, the drop has been more pronounced in the comparison area, with the result that differences in child mortality between areas had narrowed considerably by 1990.

Thus, while some differences between the intervention and comparison areas in infant and child mortality levels are evident, they are not large in absolute terms and have remained steady or even diminished over time. Differential mortality levels, therefore, do not appear to account for much of the difference between areas in contraceptive-use levels. At the same time, the possible contribution of differential perceptions of child survival risks among inhabitants of the two areas, as a result of intensive preventive and curative health services provided in the intervention area, cannot be ruled out.

3. 3. Differences Between Areas in the Demand for Family Planning

Differences between areas in the demand for family planning also fail to provide an adequate explanation for the higher contraceptive-use levels of the intervention area. Table 6 (facing page) summarizes available data on reproductive preferences

CONTINUED...
Contraceptive Use in Matlab in 1990

among women in the Matlab intervention and comparison areas over the 1975-90 period.

Rates have been standardized in the 1990 intervention area distribution of living children to take into account differences over time and between the two areas in achieved family size, which can influence responses to such questions. It is evident that the proportions of women wanting no more children were almost identical in the two areas in 1990.

Between 1984 and 1990 there was a slight increase in these proportions in both areas. Although data for the percentage of women who want no more children for the comparison area are not available prior to 1984, data from the intervention area suggest that a major shift in fertility preferences appears to have taken place during 1977-84.

Data for a second measure of reproductive preferences, ideal family size, are also presented in this table. Three important findings emerge:

1) ideal family size was virtually identical in the intervention and comparison areas in 1990;

2) consistent with the data on preferences for additional children, a comparison of the 1975 and 1990 survey results suggests that a major decline in the number of children women prefer to have has taken place in both areas over this period, from roughly 4.5 children in 1975 to slightly more than 3 children in 1990; and 3) in addition to this pronounced shift towards smaller ideal family size, there has also been a marked increase in the number of women who believe such decisions to be within their control.

TABLE 6

Reproductive preferences among women in the Matlab intervention area, 1975, 1977, 1984, and 1990 and comparison area, 1975, 1984, and 1990

Preference	Intervention area				Comparison area		
	1975	1977	1984	1990	1975	1984	1990
Want no more children (%)[a]	-	36.9	49.8	54.3	-	51.6	55.6
(N)	-	(13,605)	(3,123)	(4,181)	-	(1,966)	(3,613)
Ideal family size[a]							
Number of children	4.4	-	-	3.1	4.5	-	3.2
Number of sons	2.7	-	-	1.8	2.6	-	1.9
Family size "up to God"(%)	17.1	-	-	1.3	27.1	-	2.6
(N)	(269)	-	-	(4,238)	(238)	-	(3,708)

[a]Standardized on 1990 intervention area distribution of number of living children.
Note: (-) = data not available.

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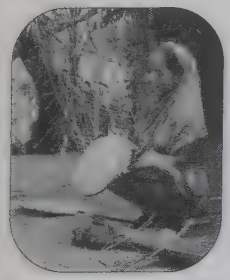
Contraceptive Use in Matlab in 1990



While substantial numbers of women believed such decisions to be "up to God" in the 1975 survey, by 1990 these numbers had declined to a negligible level.

No appreciable differences were evident between areas in the strength of demand for fertility limitation (see Table 7, below).

In the intervention and comparison areas, similar percentages of women who wanted no more children indicated that they would be unhappy with an additional son (61 and 65 per cent, respectively) or an additional daughter (69 and 70 per cent, respectively).

Modest differences were evident, however, in the underlying demand for spacing births. Among women who wanted more children, 35 per cent in the intervention area expressed a preference for delaying the next birth for more than four years, compared with 24 per cent in the comparison area.

To compare data on another dimension of demand for family planning, female respondents in the intervention and comparison areas were asked if they approved the practice of family planning, and if they believed that their husbands and close family members approved it (not shown).

The respondents' approval was almost universal (97 and 91 per cent, respectively). In both areas a large proportion of the respondents believed that their husbands (81 and 74 per cent) and that their relatives (85 and 70 per cent) approved it.

3. 4. Differences in Service-Delivery Programmes

Another explanation for the high contraceptive prevalence of the intervention area lies in differences between the two areas in service-delivery programmes. A central feature of rural Bangladeshi society is the institution of *purdah,* a set of social,

CONTINUED...
Contraceptive Use in Matlab in 1990

TABLE 7

Underlying fertility preferences, Matlab study areas, 1990

Preference	Intervention area (%)	Comparison area (%)
Among women who want no more children:		
Unhappy with		
Another son	61.1	64.6
Another daughter	69.0	70.0
(N)	**(2,270)**	**(2,102)**
Among women who want more children		
Preferred timing		
Within 1 year	20.5	18.2
After 2-4 years	43.4	54.0
After >4 years	34.7	24.0
Uncertain	1.4	3.8
Total	100.0	100.0
(N)	**(1,911)**	**(1,511)**

economic, and cultural restrictions that confines women to a subordinate position. *Purdah* limits women's power to make independent decisions as well as their ability to interact with men who are not relatives, and restricts their physical mobility (Abdullah & Zeidenstein, 1982; Mandelbaum, 1988.)

As a result, women in rural Bangladesh are unlikely to venture beyond the vicinity of their village or *bari* (family compound) unaccompanied by male family members, even for such basic needs as health or family planning services.

Under such conditions, outreach services delivered to the home by female providers become crucial to maternal and child health and family planning services (Simmons, *et al.*, 1988; Simmons, *et al.*, 1990).

In the comparison area, MCH and family planning outreach activities are primarily the responsibility of government female field workers, called Family Welfare Assistants (FWAs), each of whom is assigned a fixed geographical area with an average population of 4,000; they are expected to visit each eligible woman in their area at least once every two months.

Although male government outreach workers (called Health Assistants or HAs) also function in both areas, and family planning services are included in their job description, evidence from both the Matlab area and the two ICDDR,B Extension areas indicates that their involvement in the discussion or delivery of family planning services is minimal (Khan, *et al.*, 1989; Hossain, *et al.*, 1987).

In the intervention area, outreach services are the responsibility of both government FWAs and the ICDDR,B community health workers (CHWs). In practice, however, the government has largely yielded responsibility for outreach service delivery to ICDDR,B, and plays a nominal role.

Results from the 1990 survey confirm this: Only 16 per cent of women in the intervention area report that they were visited by a government FWA during the three months preceding the survey; 98 per cent reported one or more visits by an ICDDR,B female field worker during the same period.

During this period female government field workers made only 4 per cent of the total number of visits in the intervention area. Thus, the observed differences between the intervention and comparison areas in outreach services are almost wholly a reflection of differences between ICDDR,B and government service programmes.

In the two areas marked differences are evident in the reported frequency of visits during the three-month period preceding the survey (see Table 8, overleaf).

While 93 per cent of women interviewed in the intervention area reported having been visited three or more times by a female field worker during the preceding three months, only 6 per cent of the comparison area respondents reported a similar number of visits; 60 per cent of the respondents in the comparison area report having received no outreach visits during the preceding three-month period.

A key finding shown in this table is that almost two-fifths of women interviewed in the comparison area (39 per cent) report never having been visited by a female field worker. Given that rural Bangladeshi women are generally unable to reach such services independently, they are likely to have remained unserved by the formal MCH and family planning service-delivery programme.

CONTINUED...

Contraceptive Use in Matlab in 1990

Among women who were visited, significant differences between the two areas are also evident in the quality of outreach services. One indicator of differences in quality is the amount of time field workers spent delivering services.

In the intervention area, 50 per cent of respondents reported that their most recent visit lasted for 10 minutes or longer; only 15 per

TABLE 8

Number and length of female field-workers' visits to households, Matlab study areas, 1990

Variable	Intervention area (%)	Comparison area (%)
Number of visits reported during last three months		
None	1.7	60.0
1	1.6	21.0
2	4.0	12.6
3-4	20.4	5.9
5+	72.3	0.5
Total	**100.00**	**100.0**
(N)	(4,238)	(3,708)
Length of field-workers last visit		
Never visited	1.1	38.9
Ever visited:	98.9	61.1
<5 minutes	12.6	44.3
6-10 minutes	37.5	41.1
>10 minutes	49.9	14.8
Total	**100.0**	**100.0[a]**
(N)	(4,191)[b]	(2,265)[b]

[a]Total is greater than 100% because of rounding.
[b]Respondents who report having been visited by a female field-worker

CONTINUED...
Contraceptive Use in Matlab in 1990

cent in the comparison area made a similar report. In the comparison area, 44 per cent of these visits were fewer than five minutes long, insufficient time for the effective delivery of most family planning and MCH services (Koblinsky, *et al.*, 1989).

While 92 per cent of respondents in the intervention area reported that the field workers spent sufficient time with them, only 55 per cent of women interviewed in the comparison area responded similarly (not shown). The clients' perceptions of the quality of services provided also differed greatly between the two areas, as Table 9 (overleaf) shows. Among respondents who were visited, 80 per cent in the intervention area and only 30 per cent in the comparison area believed that the field worker who visited them was always or usually helpful in solving problems.

Similarly pronounced differences are evident from questions about the perceived responsiveness of field workers to clients' questions, the degree to which they are sympathetic to clients' needs, and the extent to which they provide enough information to clients.

Table 9 (overleaf) also shows that 75 per cent of field workers in the intervention area but only 35 per cent in the comparison area emphasized more than one contraceptive method to clients. Almost 40 per cent of respondents in the comparison area reported that during the most recent visit, no discussion about family planning methods took place.

The differences between the two areas in perceived quality of services are not confined to outreach services provided by field workers. Both areas are served by static clinics serving a population of 20 to 25 thousands each, staffed by a female paramedic, with responsibility for curative maternal and child health services, clinical contraception, and the treatment of contraceptive complications.

As in the case of outreach services, these clinics are run by ICDDR,B in the intervention area and by the government in the comparison area. Among respondents who were aware of the presence of such clinics in their area, *80 per cent of women in the intervention area and only 44 per cent of women in the comparison area believed they would be provided with good care most or all of the time if they attended.*

■

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Contraceptive Use in Matlab in 1990

Only 16 per cent of women in the intervention area report that they were visited by a government FWA during the three months preceding the survey; 98 per cent reported one or more visits by an ICDDR,B female field worker during the same period.

TABLE 9

Respondents' perceptions of the quality of service provided by female field-workers, Matlab areas, 1990

Variable	Intervention area (%)	Comparison area (%)
Is she helpful in solving problems?		
Always/usually	79.8	30.3
Sometimes	15.7	23.6
Never	4.5	46.1
Is she responsive to questions?		
Always/usually	95.1	69.1
Sometimes	4.0	21.3
Never	0.9	9.6
Is she sympathetic to client's needs?		
Always/usually	89.7	52.4
Sometimes	8.4	25.8
Never	1.9	21.8
Does she provide enough information?		
Always/usually	85.1	45.6
Sometimes	11.0	25.2
Never	3.0	29.2
How many methods does she emphasize?		
More than one method	74.9	34.6
Only one method	15.4	26.4
No methods	9.7	39.0
(N)[a]	**(4,191)**	**(2,265)**

[a]Respondents who report having been visited by a female field-worker.

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Contraceptive Use in Matlab in 1990

A community health worker demonstrates the use of condoms to a group of village women. Male-controlled contraceptive methods have little success in the rural areas.

Effective supervision is crucial to the quality of contraceptive services. Here a senior health assistant discusses method continuation with a community health worker.

CHAPTER 15

Contraceptive use in 1990

Michael A. Koenig, Ubaidur Rob, Mehrab A. Khan, J. Chakraborty & Vincent Fauveau

Lessons learned

The continued rapid rise in contraceptive use in the Matlab intervention area has been described in this paper. Since the time of the KAP survey, there are indications from Matlab service statistics that contraceptive prevalence in the intervention area has risen even further, to a level of 61 per cent in 1992. In the initial years of the programme, the rise in contraceptive prevalence was shown to be due primarily to an increase in contraceptive use for spacing births and, to a lesser extent, from a decline in family-size preferences (Koenig, et al., 1987). The more recent rise, in contrast, has been the result of substantial increases in the numbers of couples that use contraceptives for both spacing and limiting births.

Our analysis of the data indicates that the marked differential in contraceptive prevalence between the intervention and the neighbouring comparison area cannot be attributed to differences in socio-economic conditions. Nor do differences in the demand for family planning provide a satisfactory explanation, because both areas were characterized by similar ideal family-size preferences and highly favourable attitudes toward family planning. Although slightly more favourable attitudes towards family planning were evident in the intervention area, this difference may also have been due to its intensive family planning programme. Simmons, et al. (1992 and Chapter 17) have described how Matlab CHWs have influenced community attitudes toward family planning.

The results, instead, provide new and stronger empirical evidence in support of a conclusion that has already gained increasing acceptance: that the differences between the Matlab intervention and comparison areas in contraceptive-use levels are largely, if not wholly, explained by differences in the respective family planning programmes that serve them. (Similar conclusions from earlier studies, but lacking the same empirical evidence, are found in Koenig, et al. (1987) and Phillips, et al. (1988)). Marked differences were evident between the two areas in the coverage, intensity, and quality of the two service-delivery programmes. While almost all women in the intervention area report having been recently visited by a female field worker, two-fifths of respondents in the comparison area report never having received a visit. Given social restrictions in rural Bangladesh, most of these women will have remained unserved by the formal service-delivery system.

Among those who have been visited, the frequency, regularity, and quality of field worker visits were much greater in the intervention than comparison area. A high percentage of women in the intervention area, in contrast to only a minority of women in the comparison area, perceived such visits to be helpful and useful. Put in perspective, 78 per cent of women in the intervention area, compared to only 12 per cent in the comparison area, could be considered to be receiving regular, high-

quality outreach services from female field workers. Pronounced differences between areas were also evident n the perceived quality of services provided through static clinical facilities.

While over-shadowed by the steep rise in contraceptive-use levels in the intervention area, the rise in contraceptive prevalence in the comparison area during this period (from 16 to 28 per cent) is also noteworthy. This increase mirrors the trend observed for rural Bangladesh as a whole during this period.

This rise seems all the more remarkable given the sporadic nature and poor quality of services that most clients in the comparison area continue to receive from the government programme. Similar gaps in the coverage and quality of government services have been reported in a separate study, suggesting that the situation prevailing in the Matlab comparison area may be more broadly characteristic of the government programme as a whole (Koenig, et al., 1992).

Despite this impressive gain, contraceptive use levels in the comparison area remain far below those in the intervention area in 1990, with differentials persisting among both potential spacers as well as limiters. The practice of contraception for spacing births, in particular, still remains a largely unknown or uncommon behaviour in the comparison area.

The study has also documented the major decline in family-size preferences that has taken place throughout the Matlab study area over the last 15 years. The virtual disappearance of fatalistic responses to questions pertaining to family-size preferences is also noteworthy; by 1990, almost all women in the Matlab study areas framed family-size goals in terms of a specific number of offspring. The evidence, thus, suggests that potential demand for family planning services in Matlab has increased substantially in recent years, changes that have been mirrored at the national level. The persistent differential in contraceptive use between the Matlab intervention and comparison areas, however, indicates that such demand is likely to remain largely latent in the absence of intensive, high-quality family planning services.

An issue that has not been addressed so far concerns the question of the specific aspects of the Matlab programme that have been responsible for its success in family planning. The frequency and coverage of outreach visits by female community health workers have clearly played a central role in encouraging contraceptive use. An improvement in the frequency of field worker visits in the comparison area to levels found in the intervention area could, by itself, be expected to raise contraceptive prevalence. Similarly, improvements in comparison area field worker quality of care to levels found in the intervention area could be expected to raise comparison area contraceptive prevalence (Koenig, et al., 1992).

The contributions of other elements of the Matlab programme are more difficult to quantify, given the highly interdependent nature of service components and given that they were introduced together, as a service package. An important feature of the programme has been its emphasis upon a wide range of contraceptive methods, among which the home-based provision of injectable contraception stands out, accounting for half of all methods used by 1990. A shift to the provision of injectables by outreach workers in experimental projects elsewhere in Bangladesh has also been shown to increase contraceptive prevalence substantially, with this method accounting for 25 to 30 per cent of contraceptive practice.

The provision of a range of curative and preventive maternal and child health services along with family planning services has undoubtedly also made an important contribution towards enhancing the perceived quality and usefulness of the service programme to current or potential clients. Finally, a well-organized system of worker-oriented training, supervision, and management has provided the underpinnings for the successful implementation of these and other components of the Matlab service programme (Koblinsky, et al., 1984; Phillips, et al., 1988).

The Matlab project provides compelling evidence of what can be achieved in an unfavourable socio-economic setting through the introduction of an intensive, client-oriented family planning programme. As such, the project neither supplants nor argues against the need for broader socio-economic development, which remains central to the attainment of a wide range of societal goals. Moreover, there is growing awareness of the degree to which poverty and underdevelopment in such settings as Bangladesh seriously constrain the delivery of family planning services, by impeding the capacity of governments to organize and provide services effectively, by necessitating more intensive and costly outreach service-delivery strategies to compensate for weaker demand (Koenig & Simmons, 1992), and by affecting the ability of couples to make effective use of contraceptive technologies, once delivered (Seaton, 1985; Akbar, et al., 1991).

The key lesson to emerge from the Matlab experience is that even under unfavourable conditions, considerable progress can be made through the introduction of appropriately-designed and carefully implemented programmes. Within Bangladesh, where a number of other special projects have achieved considerable success and overall contraceptive prevalence has steadily increased, the observation that family planning programmes can succeed no longer generates significant levels of controversy or debate.

Attention has shifted appropriately to the larger issue of how the gap in programme performance can be narrowed between special projects, such as Matlab and the larger government programme, which the project in the Matlab comparison area in many ways typifies. Many of the operational lessons derived from the Matlab experience have been adapted to experimental areas of the government service programme (for a description of the Extension Project, see Chapter 22 and Phillips, et al., 1984a). More significantly, a number of these lessons (improvements in female field worker staffing ratios, the introduction of a field worker-oriented record-keeping system, increased emphasis upon the delivery of temporary methods of contraception, the expansion of household delivery of injectables, and the improvements in outreach paramedical services) have subsequently been adopted as government policy. These programmatic changes are making a major contribution to an event that until recently was viewed as most improbable, that is the onset of the demographic transition in Bangladesh.

Acknowledgments

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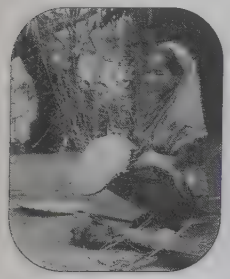
Contraceptive Use in Matlab in 1990



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Contraceptive Use in Matlab in 1990

Contraception by injection : the burden of planning one's family is on the woman, and the men prefer that it be that way.

CHAPTER 16

Effects of Parental Gender Preference on Fertility and Mortality in Matlab

Radhesyam Bairagi
Mridul K. Chowdhury

Parental preference for one gender over the other in children is common in most societies (Williamson, 1976). Some societies prefer a preponderance of sons, some a preponderance of daughters, and some a family with a balanced sex composition. The nature and magnitude of the preference depends in a large part upon social, economic and cultural factors.

If a society is patriarchal, and sons are expected to provide the economic security of parents in their old age, the preference is usually for a preponderance of sons. Most of South Asia, including Bangladesh, North India and Pakistan, belongs to this category. If the kinship system is matriarchal, and the women are economically more productive than the men, then girls are preferred. The Madugumor of New Guinea, and the Garos, a small subgroup in India and Bangladesh, conform to this category.

In contrast, if the parents depend very little either socially or economically on their children, the preference for one sex over the other is unlikely to be pronounced, and parents are likely to prefer a balanced sex composition. Present-day European and American societies generally fall into this category.

Whatever the underlying factors may be, gender preference may affect fertility, mortality, and even the sex ratio of a population. If parents desire a given number of children of a particular sex, they may continue having children. Children of the undesired sex may be neglected, and the neglect of their social, emotional and health needs may lower their chances of survival. Parents may also want to use techniques to detect the sex of the foetus, and then abort the pregnancy if the foetus is not of the desired sex.

These are some of the possible effects of gender preference on demography, the pattern and magnitude of which depend on a number of factors. Knowledge of these factors and of the magnitude of the effects of gender preference on fertility and mortality is helpful in understanding demographic trends and processes in developing societies. However, whereas studies on parental gender preference are extensive (Gadalla, *et al.*, 1985), comparatively little is known about the effects of this preference on fertility and mortality.

Part III

TABLE 1

Percentage of women giving birth during 3.5 years of follow-up by sex composition of living children, Matlab MCH-FP and Comparison areas, 1982-85.

No. of Children	No. of sons	MCH-FP area		Comparison area	
		No. of Women	% giving birth	No. of women	% giving birth
0	0	349	85	386	80
1	-	2510	78	2150	82
	0	1199	79	1083	83
	1	1311	74	1067	81
2	-	2123	72	2001	80
	0	428	79	434	82
	1	1078	72	1011	79
	2	617	67	556	79
3	-	1934	61	1777	75
	0	222	72	191	79
	1	676	64	628	76
	2	804	54	728	72
	3	232	63	230	77
4	-	1743	47	1629	66
	0	98	77	88	77
	1	391	53	378	72
	2	654	42	600	65
	3	474	42	460	62
	4	126	50	103	65
5+	-	3003	33	3214	51
	0	73	37	55	53
	1	342	44	308	52
	2	726	35	719	51
	3	859	32	910	50
	4	625	31	745	50
	5+	378	28	477	46
All	-	**11662**	**58**	**11157**	**69**

(Source: Chowdhury & Bairagi, 1990.)

CONTINUED...

Effects of Parental Gender Preference

In her pioneering work, Sheps (1963) demonstrated that actual family size exceeds desired family size if a society has a preference regarding the sex of children. Coombs (1979) showed that in Taiwan, couples with more daughters relative to sons had higher fertility in a two-year follow-up period. Park (1983) found similar results in South Korea.

However, in studies in Pakistan (De Tray, 1980), Bangladesh, India and Jordan (Repetto, 1975), it was found that there was no effect of parental gender preference on fertility, although the preference for sons in each of these countries has been very strong.

In Companiganj, Bangladesh, Bairagi and Langsten (1986) observed that although women having proportionately more daughters wanted to continue having children and did not want to use contraception, they did not have significantly higher fertility.

It was speculated that the low use of contraception in the area (7 per cent contraceptive prevalence at the time) was the reason for the absence of effect of gender preference on fertility.

The purpose of this paper is to discuss the effects of gender preference on fertility and on child mortality in rural Bangladesh, through an examination of published and unpublished data collected in Matlab.

1. GENDER PREFERENCE AND FERTILITY BEHAVIOR IN MATLAB

In Matlab, Ahmed (1981), using Coombs' preference scale (Coombs, 1974), classified 93 per cent of women as having a preference for sons; 5 per cent had no preference.

In an exhaustive review of theoretical and empirical studies carried out in Matlab, Chowdhury and Bairagi (1990) hypothesized and substantiated from the data that the effect of gender preference on fertility would be more prominent in societies with higher levels of contraceptive use than in societies with lower levels of contraceptive use.

In Table 1, facing page (Chowdhury, *et al.*, 1993), which portrays fertility in Matlab according to the sex composition of living children over a 3.5-year period from 1982 to 1985 , the effect of gender preference on fertility is clear.

At each family size level, subsequent fertility decreased with the number of living sons, except among women who had sons but no living daughters. This curvilinear pattern was not found for women with fewer than three or more than four living children. Most of the women with more than four living children were expected to have one or more living daughters.

As a result, unlike women with three or four living children, there was no upward trend in the curve at the end for the women with five or more living children. On the other hand, the absence of the curvilinear relationship for women with one or two children, but the presence of this relationship for three or four children indicated that women prefer a daughter to a son but only after having two sons.

Overall, the decline in fertility with the number of living children was steeper in the MCH-FP area, where the contraceptive use rate at the time of the study was 46 per cent in contrast to a rate of about 16 per cent in the comparison area.

The effect of gender preference on fertility was measured by the Arnold Index (Arnold, 1985). The reduction in fertility in the absence of gender preference was estimated as 8 per cent in the MCH-FP area and 4 per cent in the comparison area. Thus the effect was much stronger in the MCH-FP area than in the comparison area.

The hypothesis and the findings of this study explain why the effect of gender preference on fertility was not visible in the earlier studies in Bangladesh, Pakistan, India and Jordan (Repetto, 1975), in contrast to those in Taiwan (Coombs, 1979) and Korea (Park, 1983), as was mentioned in the previous section.

CONTINUED...
Effects of Parental Gender Preference

Since the contraceptive use rate in the first four countries at the time of the studies was very low compared to that in Taiwan and Korea, the effect of gender preference was absent or negligible in the former countries but present in the latter countries.

However, this hypothesis does not explain why the effect of gender preference on fertility is negligible in developed countries, where couples usually desire children of both sexes and contraceptive use rate is very high.

This inconsistency, and the work of Bairagi and Bhattacharya (1990) in Calcutta, where the effect of gender preference on contraceptive use was found to be much greater in a slum area with a low level of contraceptive use than that in a non-slum area with a high level of contraceptive use, highlight the necessity for an extension to Chowdhury and Bairagi's hypothesis.

In a subsequent study, Chowdhury, *et al.* (1993) have demonstrated, again from Matlab data, that while the effects of gender preference on fertility depend on contraceptive use, there is also a trade-off between gender preference and family size preference in contraceptive use.

In this study, they measured the effects of gender preference on fertility intention, contraceptive use and actual fertility using the Arnold Index, and investigated the change in these effects during 1977-88, when a substantial change took place in contraceptive use in the Matlab MCH-FP area. A summary of the findings is given in Table 2, below. Overall, there was evidence of an increase in the percentage of women wanting no more children at all family-size levels during this period. There was also evidence of a moderate decline in overall family-size preferences.

CONTINUED...

Effects of Parental Gender Preference

TABLE 2

Actual and expected percentages of women wanting no more children and using contraceptives, subsequent child-bearing experience in the absence of gender preference, and the corresponding SPEM* : Matlab MCH-FP area, 1977-88.

	Wanting no more children		Using contraception		Mean number of live-births	
Variables	1977	1984	1977	1984	1978-82	1984-88
Actual	39.0	54.7	19.6	38.2	0.84	0.76
Expected	44.7	63.7	23.6	42.0	0.76	0.68
SPEM*	14.6	16.4	20.4	9.9	9.5	10.5

*: The Sex Preference Effect Measure (SPEM) or Arnold's Index gives an estimate of the relative change in a fertility related variable that would be expected in the absence of gender preference.

(Source: Chowdhury, Bairagi and Koenig, 1993).

Preference for a daughter after two sons, as found in a study carried out by Chowdhury and Bairagi (1990) in the same area, was also observed during 1977-88. Gender preference did not change the percentage of women wanting no more children appreciably between 1977 and 1984.

The percentage wanting no more children increased by 14.6 per cent in 1977 and 16.4 per cent in 1984 in the absence of gender preference. However, the effect of gender preference on contraceptive use declined over the study period. In the absence of gender preference, there was an increase in contraceptive prevalence of 20.4 per cent in 1977 and 9.9 per cent in 1984.

Fertility, on the other hand, decreased by 9.5 per cent during 1978-82 and by 10.5 per cent during 1984-8 in the absence of gender preference. This last finding would seem to contradict Chowdhury and Bairagi's (1990) hypothesis that the effect of gender preference on fertility would be greater in a population with higher contraceptive use. Contraceptive use in 1984 was almost double that in 1977, but the effects of gender preference on fertility in 1978-84 and 1984-88 were almost the same.

2. GENDER PREFERENCE AND CHILD MORTALITY: EVIDENCE FROM MATLAB

In Bangladesh, the effect of gender preference on mortality is well-known. D'Souza and Chen (1980) showed that age-specific mortality in Matlab was higher for females than males at almost all ages. Chen, *et al.* (1981), in looking for reasons for the excess mortality of female children in Matlab, observed that the allocation of food and health care, two important proximate determinants of mortality, were biased in favour of male children.

In the same area Bairagi (1986) found that nutritional discrimination against female children was exacerbated at the time of famine. Koenig and D'Souza (1986) found that excess mortality of females over males began at eight months of age (the period when an infant needs supplementary food in addition to breast-milk), and that this excess peaked at ages one to four.

They concluded from their findings that during early infancy, when a child's nutritional requirements in rural Bangladesh are mostly met with breast-milk, nutritional discrimination was not strong, and that therefore mortality of the two sexes followed the usual patterns. However, when a child needed supplementary food from the family, discrimination against female children started, and the mortality ratio changed.

Koenig and Wojtyniak (1986) looked at sex differentials in the mortality of one- to four-year-olds in Matlab as compared to Teknaf. (Teknaf is another rural area in Bangladesh but with a somewhat different socio-cultural setting). They concluded that it was economic factors that were perhaps mostly responsible for the higher mortality among females.

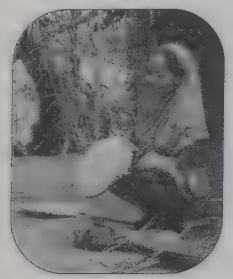
However, Bairagi (1986), and Bhuiya and D'Souza (1986) found that sex bias in nutritional status against females was relatively greater in higher socio-economic groups in Matlab. Stanton and Clemens (1986) found similar results in an urban area. Bhuiya and Streatfield (1991) showed that the excess mortality for female children was relatively greater among illiterate mothers. Fauveau, *et al.* (1991) observed that excess female mortality was confined to a few specific causes of death, namely severe malnutrition and diarrhoeal diseases.

CONTINUED...

Effects of Parental Gender Preference

Although the volume of literature on the preference for sons over daughters and on the higher mortality rate of female children over males is quite large, Gupta (1987) raised the issue of selectivity in such discrimination. Her hypothesis was that sex discrimination does not affect all female children equally, but particularly girls with older female siblings. This hypothesis was tested in Matlab for the period 1975-77.

It is clear from Table 1 that in Bangladesh parents prefer a girl to a boy after two sons. Gupta's premise is perhaps based on the



assumption that women desire at least one daughter. Therefore, any discrimination against girls would be directed against those girls who have one or more older sister.

In this study, 1,976 children aged 12-23 months were followed up for exactly two years after being weighed on a Salter scale (sensitive to 100 g) from October to November 1975.

Mortality and weight-for-age anthropometric indices were used as dependent variables to investigate the discrimination against girls. The differences between male and female children in mortality and weight-for-age were considered as measures of discrimination.

The weight-for-age of a child was defined as the ratio of the weight of the child to the weight of a reference child of the same age and sex as that of the study child, multiplied by 100. The index was based on reference data from the National Center for Health Statistics (NCHS, 1977).

Dwelling space was used as the indicator of socio-economic status. Compared with family income, educational level, and possession of articles, dwelling space was found to be the best single indicator of socio-economic status available from the 1974 Matlab census (Islam & Becker, 1979).

CONTINUED...

Effects of Parental Gender Preference

Mortality and average nutritional status measured by weight-for-age according to socio-economic and demographic characteristics are presented in Table 3, facing page).

The mortality rate per year per 1,000 children was 19 for male and 37 for female children. This difference is statistically significant ($p < 0.05$). The average nutritional status of the female children was also significantly lower (67 vs 68; $p<0.05$).

Both mortality and nutritional status were found to be related to socio-economic status and birth order. Children of higher socio-economic status had lower mortality and higher nutritional status. The relationship of birth order with mortality and with nutritional status were concave and convex respectively. In a multivariate analysis, dwelling space, and the interaction between sex and birth order appeared as significant determinants ($p<0.05$) of both mortality and nutritional status.

In order to examine whether the presence or absence of female siblings affects mortality and the nutritional status of a female child, mortality and nutritional status within each birth order were compared (Table 4, overleaf).

It is interesting to note from this table that the girls of birth order one and two did not have lower nutritional status than that of boys. The mortality of girls was slightly higher than the mortality of boys in the first birth order, but mortality in the second birth order was almost the same. The situation began to change from birth order three.

A close examination of the results of this table reveals that the presence or absence of any previously born brother or sister did not make any difference to mortality or to nutritional status in the children of either sex if birth order was controlled for. This contradicts the findings of several other studies on this issue (Gupta, 1987; Amin, 1990; Muhuri and Preston, 1991).

An explanation for the contradiction might be that Bangladesh experienced a famine in 1974-75, and it has been shown that famine may affect the level and nature of nutritional discrimination (Bairagi, 1986; Menken and Campbell, 1992). To examine this point and to investigate the changes, if any, in discrimination since then, the results of the 1975-77 study were compared with the results of a study conducted in 1983-85 in the same area (Table 5, overleaf).

In the female-male mortality ratio of children 1983-85 the role of birth order was not very prominent. In 1975-77, the sex composition within a given birth order was not an important factor in discrimination, that is discrimination was not selective

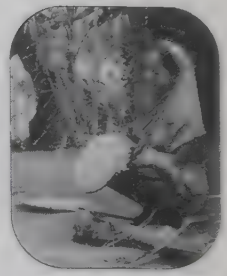


TABLE 3

Socio-economic characteristics, mortality (per 1,000 per year), and average nutritional status (weight-for-age:WA) of children in Matlab, 1975-77.

	Male			Female		
Variables	N	Mortality	WA	N	Mortality	WA
Dwelling space (sq ft):						
0 - 180	357	31	66	312	46	66
181 - 300	333	17	68	351	37	67
300+	319	9	70	304	26	69
Maternal schooling (yrs):						
0	746	22	67	684	41	66
1 - 5	235	13	70	244	27	70
6+	28	0	72	39	26	71
Birth order:						
1	170	18	68	149	30	69
2	165	18	70	153	16	71
3+	674	20	68	665	42	66
All	**1009**	**19**	**68**	**967**	**37**	**67**

CONTINUED...
Effects of Parental Gender Preference

TABLE 4

Mortality (per 1,000) and average nutritional status (weight-for-age) of the index children by sex and living brothers and sisters at the time of birth of the indexed children, Matlab, 1975-77.

	Brothers and sisters		No. of indexed children		Mortality		Nutrition	
Both	B	S	M	F	M	F	M	F
0	0	0	**170**	149	18	30	68	69
1	-	-	165	153	18	17	69	71
	0	1	69	82	7	6	70	71
	1	0	96	71	26	28	68	70
2	-	-	162	162	25	40	69	67
	0	2	25	33	20	31	70	68
	1	1	96	95	26	48	68	67
	2	0	41	34	25	30	68	67
3	-	-	175	154	9	42	69	67
	0	3	21	25	0	80	69	66
	1	2	55	51	0	30	69	67
	2	1	76	57	20	35	68	65
	3	0	23	21	0	48	69	72
4	-	-	143	158	21	51	67	65
	0	4	5	10	0	50	66	64
	1	3	36	37	42	41	68	66
	2	2	60	66	9	53	67	65
	3	1	30	36	17	56	67	65
	4	0	12	9	42	56	65	61
5+	-	-	194	191	26	40	67	65
	B <	S	83	71	12	57	66	64
	B =	S	20	16	50	32	67	63
	B >	S	91	104	33	29	68	66
	ALL		**1009**	**967**	**20**	**37**	**68**	**67**

CONTINUED...

Effects of Parental Gender Preference

and the single female child was not spared from discrimination. In 1983-85, however, sex composition was a very important factor in discrimination, and the single female child was not discriminated against.

These diverse findings from Matlab suggest that both the level and the pattern of discrimination against female children changed between the period 1975-77 and the period 1983-85. ■

TABLE 5

Mortality (per 1,000 per year) of boys and girls by sex composition of brothers and sisters in 1975-77 (age 1-4 years) and in 1983-85 (age 2-5 years), Matlab.

	Mortality					
	1975-77			1983-85*		
Sex composition	Boys	Girls	Relative Risk (G/B)	Boys	Girls	Relative Risk (G/B)
None	17.4	28.3	1.63	10.3	17.3	1.68
1 brother	15.6	28.6	1.83	19.6	20.3	1.04
2+ brothers	25.3	36.2	1.43	21.3	15.6	.73
1 sister	6.3	5.8	.92	18.0	30.0	1.67
2+ sisters	.9	24.6	27.33	9.9	27.1	2.74
1 brother & 1 sister	31.3	48.9	1.56	13.7	31.5	2.30
2+ brothers & 1 sister	26.3	45.5	1.73	22.7	37.3	1.64
1 brother & 2+ sisters	23.2	41.7	1.79	11.6	35.5	3.06
2+brothers	16.1	42.5	2.64	14.2	26.3	1.85
All	**18.8**	**37.2**	**1.98**	**15.0**	**25.4**	**1.69**

*Source: Muhuri and Preston (1991)

CONTINUED..

Effects of Parental Gender Preference

Men and women share duties in the economic life. Gender roles are usually well delineated, males outside the compound, females inside.

In a departure from traditional forming, these men are sawing timber in planks for sale in the market.

CHAPTER 16

Effects of Parental Gender Preference on Fertility and Mortality in Matlab

Radhesyam Bairagi & Mridul K. Chowdhury

Lessons learned and recommendations for further studies

Gender Preference and Fertility

With few exceptions, clear relationships are evident between gender preference and contraceptive use and fertility in Matlab from 1977 to 1988. There is no evidence of major changes in gender preference during this period. The relative effect of gender preference on the desire for more children remained almost constant between 1977 and 1984. Although the use of modern contraception increased from 19.6 per cent in 1977 to 38.2 per cent in 1984, the effect of gender preference on the use of contraception declined from 20.4 per cent in 1977 to 9.9 per cent in 1984. This decrease suggests that the relative importance of gender preference and overall family size preference as determinants of contraceptive use changed over the period, with overall family size preference being more important in 1984 as compared to 1977.

As a result, the effect of gender preference on actual fertility remained almost the same in 1978-82 and 1984-88, in spite of an almost doubling in the use of modern contraceptives during the latter period. The results from Matlab suggest that there will be an inherent change in the relative effect of gender preference and family size preference on contraceptive use with an increase in the contraceptive prevalence rate in Bangladesh. Furthermore, the effect of gender preference on fertility is expected to remain at the modest level of about 10 per cent in this country. However, there is no empirical evidence to support this assertion.

It is, therefore, recommended that data accumulated in the last three or four years from Matlab should be examined in order to establish whether the effect of gender preference on fertility will remain at the modest level of 10 per cent with the increase in contraceptive use.

Gender Preference and Mortality:

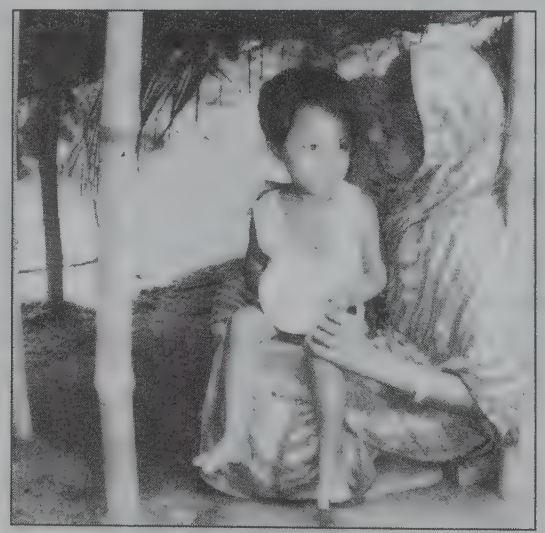
Discrimination against female children in intra-family allocation of food and health care and its effects on children s mortality and nutritional status in rural Bangladesh is well-known. However, knowledge about the socio-economic and

demographic correlates of discrimination is somewhat inadequate. Several attempts have been made to investigate the correlates of discrimination with reference to Matlab data and to determine whether this discrimination is selective.

The results of the 1975-77 study suggest that in families of one or two children, neglect of or discrimination against girls was negligible. However, girls of third or higher birth order were subjected to discrimination irrespective of the sex composition of the children in the families: that is, in large families, even the single female child was not spared from discrimination or neglect. Bangladesh had a severe famine in 1974-75 and the results of this study might have been affected by the recovery process after the famine. Moreover, there have been many changes in the demographic scenario and some changes in women's status in Bangladesh since then (Simmons, Mita and Koenig, 1992).

The difference in the level and nature of discrimination in the 1975-77 period as compared to 1983-85 may be due to the effect of the famine and changes in the demographic scenario and women's status.

It is, therefore, recommended that an investigation is made into whether the sex difference in mortality and nutritional status was responsive to all the possible influences mentioned above. The results of such a study would be helpful in formulating policies with regard to the reduction of discrimination against female children. The data accumulated from the Matlab project would allow for the undertaking of such a study.



Socio-economic constraints impose a gender preference towards male offspring in rural Bangladesh. Most families wish to have at least two or three boys.

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Effects of Parental Gender Preference

Despite the fact that boys are the preferred gender, girl-children accept what is a fact of life and phase gracefully into their adolescent and adult roles.

CHAPTER 17

Changes in Women's Status in Matlab

Ruth Simmons
Rezina Mita
Michael A. Koenig

Part III

Although family planning programmes are typically directed at women, their effects on women's lives are not yet fully appreciated. A central gap in understanding concerns their impact on women's status or position in society. Family planning programmes can have a positive influence on women's status through two key mechanisms: the liberating effect of contraceptive use, and the social dynamics set in motion through the opportunities for gainful employment that such programmes often provide to women.

A study undertaken in the Matlab Family Planning and Maternal-Child Health Project investigates how family planning affects the status of women through the medium of the community worker in Bangladesh. The article presented here focuses on the linkage between employment in family planning and women's social position within the community.

In the rural areas of South Asia, family planning programmes are major employers of women as community workers. Female workers are usually chosen to act as the point of contact with rural populations in these societies, because family planning programmes are directed at women, and because women are restricted in their contact with the outside world, especially with men.

Consequently, jobs for women have become available in settings where opportunities for female professional employment are generally scarce. However, the ability to respond to such opportunities is constrained by women's low status, that is by the same set of social forces that necessitate household visits to clients. This situation is especially true for an Islamic country, like Bangladesh, where women's dependency on men is particularly strong.

Women's social status in Bangladesh is directly tied to the institution of *purdah*. This social system, which insists upon strict segregation of the sexes, allocates to men the control over resources and influence and confers status to women vicariously through their association with men (Abdullah & Zeidenstein, 1982). Bangladeshi women generally have no direct control over the means of production or other social and

**The text of this chapter is a modified version, reproduced with the permission of The Population Council, of an article published in Studies in Family Planning (March/April 1992; 23(2): 97-109) under the title "Employment in Family Planning and Women's Status in Bangladesh", by Ruth Simmons, Rezina Mita, and Michael A. Koenig.*

Purdah restricts the movement of women outside of the family compound, and imposes modesty whenever they have to go out.

CONTINUED...
Changes in Women's Status

economic resources, but must seek security through their husbands, sons, or other male kin (Cain, 1978).

In the world of *purdah,* women are expected to perform familial rather than extra-familial roles and to avoid contact with the public realm, especially in terms of employment and exposure to strangers.

Nonetheless, experience has shown that some women have been able to overcome cultural proscriptions and to respond to new employment opportunities. For example, the government health and family planning programme in Bangladesh, as well as many non-governmental projects, has been able to employ rural women as outreach workers in all parts of the country.

Accepting employment, however, *places community workers in conflict with established social and cultural norms.* Instead of adhering to the principle of female seclusion within the private sphere of the home, the community worker transgresses into public or male space. She leaves her home without the guardianship of her male kin and interacts freely with all segments of the local community in pursuit of a set of tasks that violate existing norms of social decency and morality.

Although the potential for a loss of status from such deviant behaviour is immense, degradation does not necessarily occur. As we show, women's performance of new roles in the Matlab project has led to marked improvements in their standing in the community.

To understand the process through which this change occurs, we examine the effects of employment on women's prestige, professional status, and social influence. In addition, we identify the social dynamics through which these improvements occur over time.

Women's status is a concept with many different facets; in a general sense, it refers to women's unequal position in society (Mason, 1984). In this paper we focus on the workers standing in the public sphere, where they have struggled the hardest to establish their

professional and social influence while at the same time maintaining the culturally defined prestige inherent in their gender.

In this paper, "prestige" refers to the respect that the community worker is accorded because she is a woman who adheres to the high Bangladeshi standards of honour and morality. 'Professional status' is defined as the trust and influence the community worker has gained as a result of her expertise in the field of health and family planning, her access to special resources, and the quantity and quality of services she delivers.

"Social influence", on the other hand, reflects the workers ability to affect others in matters outside of health and family planning, in such areas as settling disputes, giving financial advice, and helping with other critical family decisions.

1. BACKGROUND AND METHODOLOGY

The data are derived from a focus-group study conducted from 1987 to 1988 in the Matlab Maternal and Child Health-Family Planning Project (MCH-FP) (see Chapter 6; Phillips, *et al.*, 1988; Rahman, 1986).

When the project began in 1977, most of the women selected to be community workers were relatively young, all were married, all had experience with contraception, and all had at least an eighth grade education. Turnover has been low; many workers have been with the project for the last decade, most for at least eight years.

The average age of workers interviewed in connection with this study was 34.2 years, and they had an average of 3.2 children. The analysis presented here is restricted to workers who have been with the Matlab project for most of the past decade.

The study is based on focus-group methodology (Krueger, 1988; Morgan, 1988) and on the authors' considerable familiarity with the Matlab project. Sessions were held with several different groups in the community to capture a possible variation in perspectives.

In addition to focus groups with female field workers, discussions were conducted with their husbands, other community women, community leaders, and educated women of a comparable social background to that of the workers but without gainful employment.

Twelve sessions were held with groups of 3 to 5 respondents, representing 44 of the 65 workers who have been with the Matlab project since 1980; 17 sessions were conducted with community women, six with educated women, four with workers' husbands, and two with community leaders, amounting to a total of 41 sessions. Due to data loss, analysis was restricted to 36 sessions. Focus-group sessions were taped and translated verbatim by Bangladeshi translators.

To assure representation of workers from different types of villages within the Matlab project, work areas were grouped into a four-fold matrix, defined by the workers performance and by the nature of the socio-economic setting, including measures of conservatism, poverty, accessibility, education, and land value.

Ratings of socio-economic setting and performance were obtained from mid-level and project supervisors. Three worker groups from each cell were then selected and brought together for a discussion.

Selection of the remaining groups was also based on the four-cell matrix to assure equal representation of participants from each type of area, although variation in the setting was not extensive.

Group sessions with workers, husbands, and community leaders

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were conducted at project headquarters in the Matlab station. Other sessions were held in the village of one of the group members.

Discussions provided the workers an opportunity to share experiences with their colleagues, and to think and talk about their lives in ways that they ordinarily have no occasion to do.

Their familiarity with one of the moderators, who herself lives in Matlab and has worked for the project for several years, contributed to reducing social distance and creating a congenial atmosphere. The workers were frank and talkative beyond the authors' expectations.

This paper on the workers' standing within the public domain is part of a larger analysis — using the data described above — that is intended to assess the impact of the Matlab project on the status of women.

The analysis presented here is based on relevant sections of all focus groups, but a fair amount of emphasis is given to the accounts of the community workers, because they most eloquently describe the dynamics of the social transformation that has occurred over time.

A comparison of transcripts from different groups reveals a remarkable homogeneity in themes, but the most colourful and detailed accounts are those of the workers. Their perception of the skills they have in dealing with clients is illustrated in the following comment:

"Yes, we have to talk a lot, explain many things, argue with different kinds of people. They say something and we speak against it. We did not know before that we could talk so much. It seems as if we have a talking machine in our stomach."

Each quotation in a given section comes from a different respondent, and excerpts from as wide a range as possible of worker transcripts were used. Of course the question might be raised whether the transformations described in connection with the Matlab workers have been entirely uniform, or whether some selectivity has intervened to determine the outcomes, with less successful workers having resigned. A number of resignations certainly occurred throughout the life of the project, but more important than resignations have been terminations of workers.

A significant number of workers were terminated early on in the Project's history because of their inability to live up to the performance expectations established by project management. A major element in expected worker performance was adherence to a regular schedule of household visits. Some workers were terminated because of their inability or unwillingness to adhere to such a strict work regimen.

The intensive community resistance to the workers, especially in the initial months and years of the project, is likely to have influenced worker failure in this respect.

It is also true that new workers were selected with a view towards choosing women with the type of personality characteristics that would withstand these pressures. In this sense, it is correct to speak of selectivity in the results.

However, it must also be taken into account that by selecting women with the type of social background and personality characteristics that gave workers the strength to break with tradition and function as innovators in the community, the project made it possible for workers to establish new social norms whereby women could maintain their prestige and gain professional status and social influence.

Once these norms were established, new recruits into the community-worker role gained professional status and social influence much more readily than had the initial cohort of workers.

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Quotations from transcripts are extensively used, with only minor editorial changes, because they convey a sense of the social realities through which employment changed the lives of female family planning workers. Since the over-arching patterns described here are so uniform for all workers, we present a case study of the changes that occurred over time without reference to the minor variations that exist in the data.

2. WOMEN'S PRESTIGE

In a traditional Islamic society, such as rural Bangladesh, a woman's prestige is derived from the extent to which she abides by the norms of purdah. Abdullah and Zeidenstein (1982) characterize the purdah system as follows:

"The strict practice of purdah is a social and religious ideal in rural Bangladesh. Strict practice means that a woman stays within the family compound or bari, which is usually surrounded by a wall of vegetation and sometimes has screens of woven rushes to protect the inner courtyard. If possible she stays within the inner courtyard... She is never seen by any but close family males... If a woman in strict purdah must go out to visit her parents once or twice a year or for an emergency, she will wear a burkah, a loose garment that covers her from crown to toe."

Purdah, in other words, is a system of secluding women and enforcing high standards of female modesty (Papanek, 1973).

Employment as a field worker in the Matlab project required a set of behaviour entirely inconsistent with these concepts of modesty and female seclusion. Shortly after their initial appointment, field workers began making daily rounds in their villages, visiting every household in their area twice a month for health and family-planning education and contraceptive distribution. They also started attending meetings for supervision and training at the nearby subcentre or at the headquarters in Matlab Bazaar.

Although some women accepted the workers' services, the dominant reaction of the community was hostile. Here were women from respected, middle-class families who would generally be expected to set an example to others by their strict observance of *purdah*, making daily rounds through areas they would normally not visit, not even in the company of trusted relatives.

Moreover, they talked about women's reproductive health and contraception, subjects not considered acceptable topics of conversation, certainly not with outsiders. Above all, they were seen working with male supervisors and other male project staff. They had ventured into male space and interacted with men who were not part of their immediate families.

The response from the community was one of shock, almost disbelief, and fierce criticism. In the villagers eyes, the workers had lost the honour and respect accorded to women who observe high standards of female modesty and seclusion. Referring to a religious story according to which the devil would come one day to lure people away from obedience to God, the workers were viewed as the incarnation of an unfortunate evil that had befallen the community. They had vivid memories of these early reactions:

"Many people used to say many bad things. They used to say that a khanedarjal, *a devil, has come to the village in order to destroy the women. They would not even look at us, or used to tease us whenever we passed their houses."*

"They used to say, '*One person's wife is working with another man. A* khanedarjal *has come, that is why there is poverty everywhere, there are no crops. They are working and going through the fields during monthly menstruation. Hence there is no paddy. The country is becoming a hell. Evil will fall on us. We suffer from rains and flood."*

"Don't you remember what that moulana [local religious leader] used to say when we just began our work? He used to gather a

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religious instruction meeting and used to say: 'All those women who have come to the field, they are not good, they are the khanedarjal. *They will walk behind men with a bag on their shoulder, an umbrella in their hand. They call themselves doctors; they are not doctors but prostitutes.'"*

Not a modern health worker but a devil had come, bringing floods, crop failure, poverty, and doom.

Clearly, when women lose their honour, they are viewed as hurting not only themselves but the community as a whole, shaming everyone:

"Many women used to cry out, *'Oh! The whole day will pass in sorrow, we have seen that mischievous woman'."*

"One day a respectable person of the village said: *'I cannot lift my head because I feel such shame. These women seem to be the tails of those doctors and supervisors'."*

A pivotal theme in the workers' recollection of their early experience relates to their association with male doctors and project supervisors. Since the workers do what women are not supposed to do - work with men - community members either question their gender or accuse them of being immoral women who chase men.

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In the words of three workers: "If I went to a *bari*, all of the women of that *bari* would gather together and would pinch each other and say: *'Who is she? Is she a woman or a man, going from this village to that one? We never saw a woman doing such a dirty job'."*

"About me they say: *'The bride of that big bari is educated and does such type of work. She walks from house to house and runs after men. She has no sense of shame .. She has a husband at home but still runs after men'."*

"You cannot imagine *'apa'* [sister], what these people used to say when we first started working. They used to say: *'That bari has no fence, so it has allowed the bride to roam around the village like a shameless bitch'."*

Women's sexual impulses are not to be trusted, therefore they must be physically segregated from men. This underlying rationale of the *purdah* society (Papanek, 1973) was expressed clearly in the workers recollections of how villagers reacted to their activities:

"These women are shameless. The only thing they want to do is run behind men. They will seek love from any men they find."

Some people, especially the moulanas, said that these women are not satisfied with their husband, so after enjoying them for some time they get bored and start roaming behind a new man."

If women violate the norms by which they are bound to accept the status of dependency - here expressed in severe restrictions on their physical mobility and professional interactions with men - they challenge the established bases of social relationships.

Depicting such women as evil forces that bring disaster and shame, questioning their very womanhood, or accusing them of being prostitutes are logical consequences of this challenge. Women who break gender norms are ridiculed not so much because they harm themselves, but because the loss of their prestige undermines the very foundations of society.

The workers themselves did not agree with the perceptions of the community. In their view, employment in the Matlab project did not entail a loss of their prestige as women.

For workers, reconciling the contradictions inherent in these new activities and the demands of female seclusion involves the concept of "inner *purdah*".

This construct** shifts emphasis from the external and physical criteria of seclusion to an internalized, moral code of conduct.

Observance of inner *purdah* does not require physical seclusion; rather, it manifests itself through politeness in interpersonal behaviour, religious orthodoxy, modesty in dress and language, and, above all, through strictly professional behaviour and attitudes toward men.

As long as this new moral code of conduct is followed, workers argue, *purdah* is not broken:

"But I do not mind them saying such things. I will be able to work with a hundred men. Nothing bad will happen if I remain perfect. My mind is the greatest thing. If I can maintain a distance and work with them, nothing will happen."

"Apa, the main thing is one's belief....If you are clean internally, then no one will be able to insult you. We are human beings so we have some errors, but we have to try to remain as pure as we can."

"The main thing is that your mind must be clean. If I wear burkah, but when I see a man I think it would have been better if I had been married to that man, then will my mind be clean?

"If my mind is not clean, I cannot be pure by wearing a burkah. And it is much better if I can work with prestige even without wearing burkah."

Ultimately, the workers' view of inner *purdah* has prevailed. In the mid-1980s, after a decade of adherence to the dictates of the internalized moral code, the Matlab workers' prestige has been restored, even in the eyes of the community.

A few dissenters continue to grumble about the loss of traditional standards of female modesty and seclusion, but they constitute a small minority.

In one of the focus-group sessions where community women discussed the current reputation of workers, a village woman herself uses the term "inner p*urdah*" to justify the workers' behaviour:

"Apa, listen, I heard a story from my father and I think this is the right example for women. It is a story from hadis [Islamic religious text], which says that Bibi Ayesha, wife of the Prophet Hazrat Muhammad, served water to soldiers on the battlefield, but did not break her purdah. Apa, our body is covered with skin. Soul and conscience remain under it. The purity of a woman is her inner purdah. Nobody can see it or break it unless she herself breaks it."

Workers depart from social convention only as far as necessary to perform their jobs, otherwise they abide by traditional principles of appropriate female behaviour. Maintaining distance from their male supervisors, even though they must interact with them, is an example of the sophistication with which the women steer the narrow path between innovation and outrage:

"When we go on duty, especially with our supervisor, we have to talk to him. I walk behind him. So if he has to say anything, he has to turn around and say it. If the village women see this they will laugh and implore us to say what we were talking about. They will not believe that we were talking about the patients. Even after going to a bari I try to remain as silent as possible - only talk to my supervisor when necessary. But after seeing this and seeing that we do not talk about rubbish or do not go anywhere else other than work, they began to respect us."

"They also see the way we are walking, the way we are behaving with people, even with men. They do not find any fault with us. Each and every one has become acquainted with each other. We are like a family now."

This strategy of affirming the traditions of purdah wherever possible while strictly limiting violations to what is professionally necessary is one reason workers succeeded in regaining their prestige in the eyes of the community. However, other factors also explain the workers success in maintaining their prestige as women.

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If workers appear extraordinarily capable of withstanding community pressures and accusations, it is in large measure a reflection of project management.

The selection of workers was guided by considerations of their ability to face provocation and abuse in the village, and continuing management support was provided to aid workers in performing the delicate socio-cultural tasks in the village. Moreover, maintaining or regaining prestige was closely associated with the professional and social activities workers performed in the village, which, in turn, led to the acquisition of hitherto unknown dimensions of status for women.

3. PROFESSIONAL STATUS

In the ideal-typical interpretation of the purdah society, there is no place for women as professionals. Thus, by definition, women are not accorded professional status. A woman's role is limited to the private sphere of the home, where she carries responsibilities for both reproduction and production. Until the introduction of the female family planning and health worker in the mid-1970s, teaching had been the only occupation open to women.

In the initial period of employment, Matlab workers commanded neither the trust nor the influence necessary to encourage new patterns of contraceptive and health behaviour. Although some villagers accepted their services, the overwhelming community response to the workers professional role was negative.

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Given their initial loss of prestige as women, it is not surprising that in the early days of the project the community refused to recognize the standing of these women as professionals. Their core functions — contraceptive education and service delivery — were considered by many to be outright harmful, an insult to the God-given order of society. An educated community woman expressed the villagers initial reactions as follows:

"They used to think that she is doing the people harm. Why should she stop fertility? Let the embryo develop. God is the creator and he is giving birth. So she has no right to give tablets, injections, and other methods and stop pregnancy."

Although the initial focus of the Matlab project was on family planning, workers also distributed medicines for minor ailments. The community, however, was suspicious even of this function, because it was tainted by family planning. As one worker remarked:

"... at the beginning of our work we had to face many problems. Many people made comments. Said bad things. Even if we gave them medicines, they used to throw it away and talk behind our backs."

Creating acceptance for a new occupational role for women and legitimising family planning as an essential community service were the two major tasks faced by workers in the beginning. Despite strong cultural barriers, the Matlab workers succeeded in becoming influential and respected voices in the community, women who speak with authority on matters related to family planning, health, and family problems.

They are not only respected for providing services to those who want them, but are equally appreciated for their role as strong advocates for family planning and preventive health — as individuals who actually influence family decision-making.

Service statistics showing a rise in contraceptive use from 7 per cent to 33 per cent over the first 18 months of the project testify to the workers' success in promoting family planning.

Subsequently, prevalence plateaued for two years, but then increased again, though more slowly than it had in the initial period, and reached 50 per cent by 1988.

The workers and others in the community concur that this trend reflects the workers' perseverance in establishing themselves as

trustworthy individuals and as professionals whose message and services benefit the community. For some workers, successful pursuit of this strategy involved establishing trust with influential members of the older generation:

"I first tried to establish a congenial relationship with the *matabar's* [village leader's] family. The *matabar's* mother is a very old woman and is very rude too. So I used to go to visit her quite often, talk to her, give her medicines. Gradually she became very friendly with me.

"Then I told her about family planning saying, 'Your daughters-in-law should take contraceptives, for if you have too many grandchildren there will be chaos in the family, they will not get proper attention, and hence one will become a vagabond, another will steal things from other houses and gardens.'"

She understood this and then told her daughters-in-law to talk to me about the different family planning methods. Then I started talking to other women of the village. Some believed me while some did not. I used to give the reference of *matabar's* mother and other women of the house.

"They used to come and ask the old woman about me, whether I am telling the truth, whether the family planning methods are beneficial. The old woman used to say that all are true, and her own daughters-in-law have also taken family planning methods. Hearing this, the other women used to come to me and ask me to give them family planning methods."

Gaining the trust of the community and creating acceptance for the value of contraceptive use required patience, perseverance, and creative ways of communicating their message to women:

"We are going to the community women with the family planning message, explaining the same topic over and over. If one keeps on rubbing a stone in one point, the stone begins to wear away. Like that the mind of a human being can easily be influenced by our repeated hammering."

"We used to say: 'Have you not noticed that if the weeds of the paddy field are cleaned, then a paddy plant becomes healthy and yields good crops? A mother is also like a plant, if she has few children, gets a nutritious diet, then her health as well as the child's health will be better. So don't you want a healthy mother and child, or do you want an unhealthy and sick mother?'."

The workers' ability to facilitate access to curative care helped bring about acceptance of the family planning message:

"Many people really do not like us working for family planning, but they also see that we are helping them. One day during my duty I went to a bari and found a small boy with cholera. But his parents were using a charm. I quickly went inside and then started scolding the mother, wrote out a slip, and then arranged for a boat."

"Within an hour I arranged everything and took the child to Matlab [the hospital at the Matlab headquarters]. He was admitted. After a hard struggle and 15 days of treatment, he recovered. From that day his parents and other relatives started to show the special regard and honour. Many women started talking about family planning with me."

With enough people in the community experiencing the benefits of a smaller family, the workers influence is now solidly entrenched:

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"They will say: *'Apa, you have done us a lot of good. We are having a perfect time with few children. We can now put our children in one bed and then sleep with our husbands on a separate bed. We can now have some amusements. God has helped us. See that woman? She has eight children and is always having a tough time with them. One of her sons has become a thief, another two are vagabonds, roaming here and there, going after and teasing the girls of the village, another is stealing fruits*

and vegetables from other people's gardens. People come running with complaints. Isn't this a great problem? Thank God we are free from these."

The worker has the respect of the community for being a doctor, a "little" doctor as she is sometimes called, but a doctor nonetheless. She is generally the only source of modern medical care in the local community and, above all, she is connected to the senior doctors of the project in Matlab Bazaar, who can provide care when her skills are too limited.

No longer are her medicines thrown away. She is called upon and respected for medical help that exceeds formally prescribed job responsibilities, including the administration of injections for curative care and emergency transport to the Matlab hospital:

"Well, apa, we have learned many things. To give medicines, administer injections. So if we go to a bari then people will come and request that we give them an injection. They have bought everything but are not able to do it themselves. There is a woman who has to be given two injections twice a day - one at 5 a.m. and the other one at 5 p.m.. So she comes to me daily and I give the injection. People come to us as we are expert in these things. Otherwise, would they have come?"

"I have to help the people too. There are many burn cases in my village. But I cannot give proper treatment for burn cases. A few days ago, a girl burnt her legs ... all the people came running.

"When I got there I saw that it was quite serious. So I quickly sent for the boat and then took the girl, her mother, and grandmother to the Matlab centre. The girl had to stay at the hospital for 10 days. She got well. Whenever I go near their house she calls out to me, *Baramma, Baramma* [grandma]. Her parents and grandmother are also very grateful to me. They have gained extra faith in me."

In the eyes of the community, the workers have become indispensable:

"We can't walk around the village peacefully now. A man will come running saying: *'My son has fever, come to our* bari*'*, or, *'My wife has stomach pain, cannot get up from the bed, what shall I do?'* If I say, 'I do not have any medicine. I am giving you a slip and am referring your wife to the Matlab hospital. Take her there. There will be no problem.' Still they are not satisfied. They want me to take a look and give medicines. So no matter what problems the people have, we have to attend to those. They will not trust anyone else."

Workers have acquired new skills and resources that allow them to provide valued services and gain access to other medical care facilities. In this respect, they occupy a unique position within the Matlab community, which typically some traditional healers have but only in rare cases allopathic physicians enjoy.

Government health and family planning staff are also employed in the area, but their services and referral capacities are considerably more limited than those of the Matlab project. It is now widely recognised that Matlab workers contribute to the community's welfare:

"When the people observed that we do not mean any harm but are working day and night for the welfare of the people, their attitude toward us started to change. At present, they behave in a friendly manner. We get full co-operation from them.

Many women will say: 'You have taught us many good things. We are very happy and living in peace. We can eat better food, wear nice clothes, can send our children to school.'"

Acceptance of the workers' role as modern health and family planning professionals came at a considerable price, involving regular confrontation with hostile villagers, and, on occasion, threats to their personal safety.

Particularly in the earlier years of the project when ties to the community were not as thoroughly established as they are today,

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workers faced hostility and threats, without an adequate support network. Supervisors were available but not always readily.

Thus, the workers have had to confront conflict and opposition in the field as they arise. The following is an example from more recent years where a worker tried to administer a tetanus injection:

"Once I went to a bari. The wife had given birth to a still-born baby. Then she conceived again, but the husband would not let me give her a tetanus injection. He would not understand that tetanus should be given during pregnancy.

"According to him, why should I give the injection during pregnancy? Do I want to kill the baby? Now he has two daughters but I do not enter his house even now. If he sees me he comes running with a bamboo stick in his hand like a wild dog."

Certainly, individual cases of conflict and resistance to the worker's role continue. Not everyone follows their advice on family planning; not everyone is ready to accept the preventive health services they provide. But, for a large majority of the community, the workers professional standing and influence are undisputed.

4. SOCIAL INFLUENCE

The villagers' trust in the workers extends to a broad range of issues, which exceed their formally-defined health and family-planning responsibilities. In the community, workers have become social leaders, as well as valuable resources to women who live under the dictates of seclusion and are, therefore, generally barred from seeking the assistance of outsiders. It might be argued that such influence is also a function of the workers' education and age. However, their physical mobility within the village and their role as professionals have vastly expanded the scope of their role as social leaders.

Their help is sought in connection with a range of social issues that arise within families or among neighbours. These issues include marriage arrangements, children's education or occupations, and conflicts between husbands and wives, mothers-in-law and daughters-in-law, and among neighbours.

More specifically, many of the conflicts that workers mediate in underscore the low status of women in Bangladesh. They reflect expectations regarding modesty, restricted physical mobility, powerlessness within the husband's family, or helplessness in the face of a husband's desire to take another wife.

Young, recently married women are particularly in need of the advocacy role that workers have learned to perform, because their influence is especially circumscribed. Young women are often attracted to the modernizing influences reaching the Matlab villages, while many older women are eager to enforce traditional standards of female modesty and seclusion. In the following example, a worker defends a young woman who is considered to be too free in her behavior:

"A few months ago, a woman came to me and complained about her niece. Actually, what happened is that the girl was very free, used to talk with everyone, go to school, to the bank of the river, and to the fields. So this woman did not like it. After hearing this I told her: 'As the days have come it is quite natural that girls will be a bit free. Why don't you take it easy and think of that girl as your own daughter? You have a daughter, and if she is also like that will you throw her out of the house? Sometimes you can give her some advice.' Then the woman came to realize this and said: 'You are correct bhabi [sister-in-law]. I must be a bit liberal. She is like my daughter.'"

'As the days have come it is quite natural that girls will be a bit free.' With these words, the worker interprets the modernizing influences that are reaching the Matlab villages, letting the woman know that the standards of *purdah* are changing.

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Another example of social influence relates to control over domestic resources. Access to food is carefully regulated within the household. A young wife may be heavily involved in food preparation but does not necessarily control how much she is allowed to eat. Below, a worker intervenes on behalf of a young woman who does not receive enough food from her mother-in-law:

"In some houses the bride tells us that her mother-in-law gives her food only twice a day. After hearing this I say, 'Where is the baby's grandma? Why don't you give food to your daughter-in-law? She has given birth to a child and must take better food many times. Otherwise both your daughter-in-law and grandson will be unhealthy and will suffer from diseases.' After a few days, when I went to that house the bride told me that her mother-in-law is always telling her to eat this and that. She scolds her if she does not eat perfectly."

Although Bangladeshi women are raised with the understanding that marriage implies living with, and adjusting to their husband's kin, they cherish occasions when they can see or return to their own family. In the example below, a worker skillfully intervenes when a husband interferes with his wife's desire to see her relatives:"Once a woman came to me and said that she had a quarrel with her husband. Her sister was going to be married off. She wanted to go to her parents' place on this occasion. But her husband won't let her go. Her brother came to take her but the husband insulted him and then started beating his wife. The woman also complained that her husband always beats her if anybody from her parents' place comes. He will not allow her to give them food or even talk to them.

"Hearing this, one day I went to her house and found her husband at home. I started talking as if I did not know anything. I asked her whether anybody from her parents' place comes to see her. I also told the husband that he should invite them to come, should treat them well. 'You must be polite with your in-laws. You have two daughters. How will you feel if your sons-in-law do not allow you to go and see them?' Such talk helped a lot. When I met that woman the next month, she told me that her husband went to invite her sister and father. And they are coming to stay for a few days with her. She felt very happy."

A worker may even find herself in a position to defend a young girl's case in a love affair:

"Sometimes we have to give advice regarding love affairs ... One such case happened. A man arranged for his daughter's wedding, but then heard that his daughter is in love with a boy of the village and will not marry anyone else. Her mother came to me and told me everything. I then advised her to marry off her daughter to the boy she loves, for if the other groom's family hears about her relationship with another boy before marriage, then she will be rebuked and tortured by her in-laws. She will be happy if she gets the man she wants."

In the villages, the education of daughters is an issue that is raised with increasing frequency, often provoking intra-familial conflicts.

Here a worker advises a mother to allow her daughter to attend school against the wishes of the husband:

"Apa, there is a family that has no respect for education and where no children are educated. One of their daughters had great eagerness to study, but her father will not allow her to go to school. He and his brothers would say: 'What is the use of getting educated? We do not allow boys to study so there is no question of girls' education.'

"One day, when I went to that bari for duty, the girl's mother told me: I want my daughter to go to school but my relatives will not give permission... I then told that woman: 'Send your daughter to school, don't listen to other people. None can take away the knowledge from your daughter.'

"Then the girl started going to school and this year she passed the S.S.C. examination with a second division and letter marks

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80+ in two subjects. The day the result was published, the mother of that girl came running ... and embarrassed me by saying: 'My daughter has done so well only because of you!'"

While workers interact predominantly with village women and are probably more influential with them than with men, they can also intervene with men if necessary.

In the more conservative villages, this means that the workers generally have to work through their male superiors; in less conservative areas, they may confront the husband directly when they feel the interests of the women are at stake:

"Most of the quarrels are between husband and wife. More or less all families have some conflicts. But in some families it becomes serious. For example, there is a serious quarrel between the husband and the wife if the husband marries again. They come and tell me. I have to go and sometimes talk to the husband: 'Don't you have any sense? You have married again in such days of hardship. You already have such a beautiful wife, but have married again. What kind of a person are you?' They then feel ashamed and sometimes apologize for doing such a bad thing."

A wife and a husband have a quarrel over a piece of soap. The husband had lifted a big stone to hit the wife and was constantly saying: *'I will kill you, let me see how you enter the house'*. At that time I appeared there. All the women of the *bari* started saying: *'Naila's Ma has come'*, for they know that the husband will not hit his wife in front of me as everybody respects me.

"I said: 'What is happening?' They said: 'The man will not allow his wife to enter the house as she has lost a piece of soap.' I said to that woman: 'Bhabi, come inside with me.' Everybody started screaming: 'No, no, he will kill her.' I said: 'Let me see what happens. If he hits her this means that it will not hurt her but will be on me.' Then I started telling the husband: 'You are doing such a bad thing for only a single piece of soap. Aren't you old enough and have many children? Won't you marry off your children after a few months? And you are doing this now.' Then I heard that they did not even take their meal. So I arranged everything and told them to eat together.

"I arranged everything" the worker says, and her influence in the community is such that she often manages to settle conflicts in ways that protect the interests of women. As one worker observed: 'An obstinate husband, who does not believe his wife, will respect our decision, even if it is in favour of his wife'.

The workers' influence extends to the most central issues of social life, even to helping with marriage arrangements. The dowry system has become a major burden for families with daughters in rural Bangladesh.

Not only has there been a shift over the past decades from bride price to the dowry system, but rising expectations about the size of the dowry create financial hardship for families with several daughters, which often leads to delays of girls' marriages beyond what villagers consider marriageable age (Lindenbaum,1980).

Since marriages are arranged between families who do not necessarily know each other well, the possibility of dowry fraud looms as a major threat. Once again the worker is called upon for help:

CONTINUED
Changes in Women's Status

"One day I went to a bari and found all the women crying. I asked them what had happened. One woman said that they have married off a daughter. The groom lives in Barisal. They had to pay Tk. 7,000 [approximately $230] in cash. One of the uncles of the girl took her to Barisal. There they saw that the groom was already married. He has a wife and five children. So both the girl and her uncle returned.

"They did not know what to do and asked for some advice. I told the girl's father and uncle to go to my brother-in-law at Pabna. He

will do whatever he can. They went there and he sent his men to Barisal, caught hold of the groom and his father. They took the dowry money back. They did not give the money to the girl's father and uncle in case the groom's relatives do anything to steal the money. So they brought the money and gave it to me. I then went to that *bari* and gave the money to the girl's mother. Now they are very happy and much obliged to me."

Workers also mediate neighbourhood quarrels and are even called upon to provide financial advice:

"Many women will come with complaints of their neighbours: that the neighbour's cow has eaten their crop, goats have destroyed the vegetable garden, or about the quarrel between their daughter and the neighbour's daughter. Sometimes women from both the houses will come and start speaking at the same time. They will find fault with each other and then suddenly will start quarrelling. At that time we have to break up the fight and then try to come to a compromise."

A woman once told me that her husband works at Matlab. He will get a sum of Tk. 25,000 [approximately $830] after resigning from his work. So he wants to do so and then start a business and build a house with that money. But they could not decide what to do. She asked me to give my opinion. I told her that her husband is very safe in government service. *'There is no security in a private business, and what is the use of constructing a house? It will bring no return.'* The woman and her husband understood. The husband then told her to have gold ornaments made. I then said: *'Your wife already has some ornaments ... So keep the money, it will be doubled and you can do a good thing in the future.'* They also understood the thing, and decided not to touch the money."

From contraceptive advocacy to financial advice, female workers of the Matlab project have established their professional status and expanded their network of influence beyond what anyone would have expected. Clearly, their expertise transcends the family planning and health functions for which they have been trained.

This is not to imply that the village community is always completely satisfied with the services they receive, or that all workers are held in the same esteem. On the whole, however, Matlab community workers are widely respected, and they know it. As one of them put it:

"We feel that our status has increased a lot. Such as if we are absent during any problem, such as illness or anything else, at any wedding ceremony or festival, we hear the people saying: 'We would have been glad, and it would have been much easier in many cases if she had been present.'

■

CONTINUED...
Changes in Women's Status

From contraceptive advocacy to financial advice, female workers of the Matlab project have established their professional status and expanded their network of influence beyond what anyone would have expected. Clearly, their expertise transcends the family planning and health functions for which they have been trained.

CHAPTER 17

Changes in Women's Status in Matlab

Ruth Simmons, Rezina Mita & Michael A. Koenig

Lessons learned

Much change has occurred since eighty community women were first employed as health and family planning workers in the Matlab project more than a decade ago. This paper has focused on the effects of such employment on the workers standing in the community. Other effects will be described in future work.

Three dimensions were singled out for analysis here: prestige, professional status, and social influence. For each of these areas, a remarkable degree of change occurred over time.

Workers regained their prestige, in spite of the community s initial judgement that they had lost their honour by violating traditional concepts of female seclusion and modesty.

Concomitantly, these women received recognition for their professional expertise, community service, and control over valued medical resources. Finally, workers have established themselves as community leaders, commanding the social influence needed to arbitrate in family and neighbourhood conflicts, often acting as advocates for women.

The conceptual distinctions made here reveal the underlying dynamics of the change that has occurred. In the literature, a distinction has been made between women s prestige and female status (Mason, 1984). Women s prestige has been defined as the respect gained for adherence to culturally defined patterns of female behaviour.

Status, on the other hand, is defined in terms of women s control over resources, information, and other sources of power and influence, as well as the degree of control women have in these areas compared with men.

This paper heeds these distinctions by tracing the separate, but parallel, trends in the workers prestige and social status. The latter is an aspect of women s status, whereas women s prestige is not.

In the present analysis, the conceptual differentiation between prestige and status is as essential as the inclusion of all three variables - prestige, professional status, and social influence.

Both the community s judgment that the worker s honour had been lost and the workers creative transformation of purdah into inner purdah are part of the dynamic process by which professional status and social influence have been established.

Without regaining prestige, this accomplishment would have been impossible. Professional status and social influence, in turn, were equally essential for gaining acceptance of new standards of female behaviour.

These considerations are not just academic. They characterize a strategy of accommodation and reform rather than of confrontation and radical change. Although the effect of the workers presence in the community may ultimately have major implications for the status of women, the workers and the Project's commitment must remain, where possible, within the existing conservative definitions of gender. This strategy may well explain the workers successful metamorphosis from devils to social benefactors.

Moreover, the changes described here occurred within the context of a very supportive management structure. Selection, training, and supervision of workers were undertaken with a remarkable degree of sensitivity, cultural appropriateness, and professional commitment to quality of care.

Candidates for the position of community worker were selected not only for their formal qualifications, but with regard to their ability to withstand community opposition and to behave in ways that would engender credibility and acceptance.

Project management also provided consistent support to workers in their search for means of enhancing their standing within the community. Referrals for health care at the subcentre or the Matlab hospital must occur through the workers.

By channelling access in this way, project management promotes the workers status in the community. Also, when visiting a worker s area, senior project staff deliberately show respect to her, thereby reinforcing her image.

Finally, service delivery was supported with adequate resources, as well as with medical and administrative backup. However, such conditions do not always prevail. The social dynamics that one could expect from women s employment in other family planning projects might vary accordingly.

Although it is advisable to exercise caution when generalizing from this project to other family planning programmes, the experience should not be discounted as being entirely unique to Matlab.The status effects of employment outlined here occurred in a setting that is affected by a degree of modernization. While these changes do not amount to a major socio-economic transformation, they undoubtedly helped facilitate the status effects we observed.

However, it would be a mistake to conclude that these broader social influences were solely responsible for the changes that occurred. Clearly, the employment opportunities created by the Matlab project were essential.

Over the past decade, the lives of the Matlab workers have been transformed and, as a result, so have community expectations of the roles and behaviour that are appropriate for women.

The status of women remains low; no revolution has occurred. But the old rigidities of purdah have been transcended, and women can more freely avail themselves of employment opportunities requiring entrance into male space.

The professional and social leadership roles that community workers now perform imply control over resources, influence, and power, a degree of status that seemed inconceivable a decade ago. That such change could result from a well-designed and appropriately managed family planning project deserves close attention.

The status of women remains low; no revolution has occurred. But the old rigidities of purdah have been transcended, and women can more freely avail themselves of employment opportunities requiring entrance into male space.

Acknowledgments

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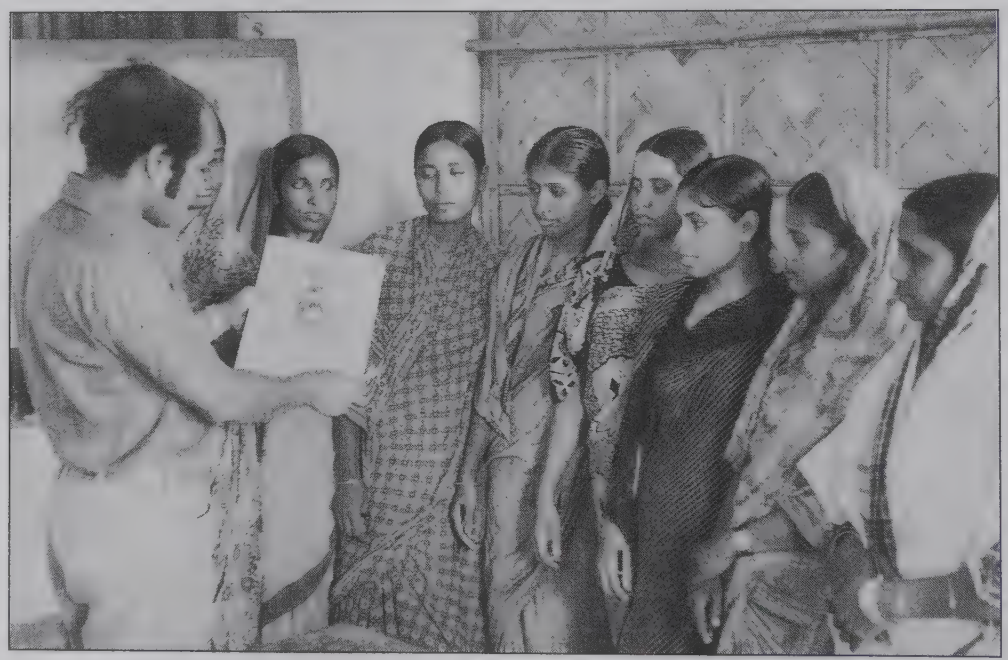


The initial stages of recruitment and training of young community health workers in the Matlab Family Planning - Health Services Project. It was unusual and ill-perceived at that time to talk about reproductive issues (On the left: Mr J. Chakraborty).

CHAPTER 18

Therapy Management and Reproduction in Matlab: Trained Nurse Midwives as an Option

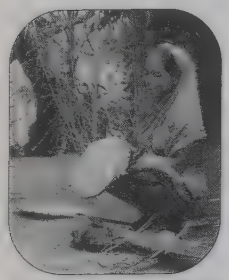
Nancy Stark
Rehana Akhter
K.M.A. Aziz
J. Chakraborty

In a recent review article on medical choice, Janzen (1987) proposed the concept of "therapy management" to describe how families or groups engage in medical decision-making and understand the control and use of medical knowledge. Regarding control of the therapeutic process, Feierman (1985) argues that health must be analyzed in the context of political and economic forces which shape social change; institutional control is inherent in therapeutic choice whether through kinship, profession or state. Accordingly, control of the therapeutic process requires a consideration of power relations. Particularly relevant to the question of power relations is the consideration of gender roles.

Gender research indicates that although female authority is circumscribed (Reiter, 1975, Rosaldo and Lamphere, 1974), women often possess informal power and exert social control (Reiter, 1975, Nelson, 1974, Rogers, 1978). Reproduction is a common sphere of control for women (Browner, 1986; Kay, 1982; MacCormack, 1982; Sargent, 1982a and 1982b, Jordan, 1978), involving decisions about fertility, pregnancy, child-birth and infant care; consequently, women may be expected to play significant roles in decision-making. Moreover, therapeutic choice often occurs in a context of multiple therapeutic options (Beals, 1976; Sargent, 1989).

Decision making in Bangladesh, the subject of this paper, is no exception. In addition to traditional birth attendants who conduct deliveries, the rural areas of the country support a range of therapy options from spiritual healers to allopathic services provided by individuals, government facilities and non-government development agencies, such as the ICDDR,B.

The ICDDR,B commmunity-based maternity care programme is a focus of this article as a therapy option. The objectives here are: 1) to document the decision-making role of women in therapy management, 2) to detail the importance of the interaction between gender ideology and the economic demands upon the household in shaping therapeutic choice to employ the home-based services of ICDDR,B, and 3) to offer options based on study results to improve community acceptance of the ICDDR,B. maternity care services.



1. RESEARCH SETTING AND BACKGROUND

1. 1. Setting

One programme, instituted by the Maternal and Child Health-Family Planning (MCH-FP) Project of ICDDR,B in 1987, placed trained nurse midwives in the Matlab MCH-FP area to work with traditional birth attendants (TBAs) and provide in-home prenatal and delivery care (Fauveau and Chakraborty, 1988).

The objective of the programme is to reduce maternal mortality in rural areas lacking accessible biomedical (allopathic) health care by providing timely identification and treatment of complications in pregnancy, delivery and postpartum.

When severe complications are discovered, the woman is transferred to Matlab for evaluation and treatment and, if necessary, on to Government or Red Crescent hospitals for more intensive care.

Two nurse midwives provide services to each of four blocks within Matlab, relying on the community health worker (CHW) to identify and refer complicated pregnancy cases.

The CHW, a village resident, visits each household twice a month providing a variety of services including iron therapy for pregnant and lactating mothers, contraceptive services and referrals to the health subcentre.

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Complicated pregnancy cases identified during these visits, or when families request services for the pregnant woman, are referred to the nurse midwives who conduct an in-home assessment and recommend appropriate treatment. Families are encouraged by the CHW and midwife to call the midwife in the case of delivery problems.

Although the midwife services are in-home and free of charge, families often employ other health options available; therefore, an analysis of therapy management must consider cultural as well as economic factors. Cultural factors which shape reproductive decisions necessarily include gender roles and expectations.

1. 2. Therapeutic Options for Reproductive Problems

The most common village health practitioners are spiritual healers *(kobiraji)*, homeopaths who may or may not have formal training, and village doctors some of whom are *palli chikitshok* (see Bhardwaj and Paul, 1986). The *palli chikitshok* possesses one year of training in diagnosis and treatment of common illnesses, whereas some village doctors may be trained as chemists or have undergone apprenticeships with other village doctors. Little is known about how and under what conditions these practitioners are used for reproductive problems, especially child-birth complications.

In contrast, the delivery practices of the traditional birth attendant and the position she occupies in the reproductive therapy process have been the focus of research and programme development by medical personnel both in Bangladesh and throughout the developing world (Blanchet, 1984; Bhatia, 1981; Islam, 1986; Neumann, *et al.*, 1974; Rahman, 1982; Claquin, *et al.*, 1982; Chen, *et al.*, 1983; Leedham, 1985).

The primary role of the TBA, locally known as the *dai*, is to promote speedy delivery and to "catch" the infant at birth (Blanchet, 1984). Pollution associated with the blood of child-birth effectively excludes her from the spiritual realm as a healer; thus her domain is limited to birth-related problems lacking spiritual aetiology.

Furthermore, the *dai* possesses an ambiguous status and, as a result, acquiesces to the wishes of the family, the primary decision-maker. Despite her ambiguous status the TBA is a key figure in the birth process whose techniques and practices have been the target of efforts to improve maternal and child health in Bangladesh.

1. 3. Gender Roles

Life for women in rural Bangladesh is characterized by a severe limitation of freedom, and a strict sexual division of labour: *Purdah* (Blanchet, 1984; Abdullah and Zeidenstein, 1982). A woman's family must pay a dowry at marriage after which she lives with the husband's family and works under the supervision of her mother-in-law.

Wives are expected to produce at least one son for inheritance purposes since, under Islamic law, daughters inherit property at only one third the share of sons. *Purdah* limits movement and access to services and employment.

As a result, the birth of a female child is viewed as an economic burden placing the parents at a disadvantage.

For example, women prepare and serve meals for the family but favour men in food allocation (Chen, *et al.*, 1981). Females receive treatment for illness less often than males.

Moreover, most health practitioners are male, further precluding access to services, particularly for reproductive problems (Blanchet 1984).

Indeed, during pregnancy and child-birth, women are subject to further seclusion to preclude illness caused by spirits. These attitudes and beliefs regarding women's roles clearly impinge upon therapeutic choice for reproductive problems.

1. 4. Research methods

A twelve-month study was conducted in two villages within Block C of Matlab. The villages (designated A and B) are located approximately one mile from the Nayergaon Health Subcentre. The population of village A is 755 with 119 families, all Muslim, and the larger of the two villages, B, has a population of 877 in 153 families, a small percentage of whom are Hindu. Table 1 (below) lists the occupations of each village.

Village A is comprised of predominantly service and business occupations while village B is primarily engaged in farming and agricultural labour activities.

Data was collected through structured and unstructured interviews, participant observation and case studies. A combined census and economic survey was conducted in each household in the two villages. Women in 100 households including 42 pregnancy cases were interviewed. Attempts were made to follow all pregnancy cases identified in the two villages.

TABLE 1

Predominant Occupations of Household Heads by Village, 1989.

A.	Occupation	Per cent in Village A (n=119)
	Business and service	21
	Farming (landowner)	17
	Agricultural labour	11
B.	**Occupation**	**Per cent in Village B (n=115)**
	Agricultural labour/farming	26
	Farming (landowner)	20
	Fishing	20

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The households were selected to create a sample representative of religion, education, family size, and occupation of the household head. The number of households from each village is also proportional to the population of each village.

Interviews were conducted with women of reproductive age, post-menopausal women who figured prominently in decision-making, and men who served as decision-makers.

The subsample of pregnant women was visited every ten days until two months postpartum to document reproductive decision-making dynamics.

During each visit the principal investigator evaluated the physical and social status of the woman and documented complications or problems identified and treated since the last visit, including decision-making episodes.

Abnormal conditions noted by the principal investigator were discussed with the family to determine their perceptions of the situation and the appropriate course of action needed. Seriously acute or life-threatening conditions were referred to the CHW or nurse midwife for transfer to the Matlab clinic.

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In addition to household interviews the research included observations of and interviews with TBAs, village doctors, CHWs and nurse midwives and a *kobiraj-dai*.

Complicated deliveries referred to the nurse midwife were observed during a one-week stay at the health subcentre and a two-week stay at Matlab. The anthropologist employed one female research assistant to assist with interviews and translations, and two male interviewers who conducted a census and an economic survey of the two villages.

2. RESULTS

Results presented here represent the analysis of data collected from the subsample of pregnant women identified in the villages. A total of 43 pregnant women were identified in the two villages during the twelve-month study. Analysis of subsample data includes decision-making, therapy management and use of therapy options, particularly MCH-FP nurse midwives, for reproductive-related problems.

Of the 43 cases identified, 34 were analysed in this subsample. In two instances, women refused to participate in the study from the beginning, whereas three other women declined to participate after a few weeks. In four cases, information was insufficient for complete analysis because the participants had either entered the study at delivery or became pregnant too late in the study. Observations of two cases not included in the subsample analysis are, however, included for anecdotal purposes.

Pregnancies from village A accounted for 35.3 per cent of cases and village B, 64.7 per cent. Tables 2 and 3 (facing page) describe, respectively, the husbands' occupations and women's education levels. Most women were married to men employed in business and service occupations (including mill workers, apprentice village doctors, policemen, clerk-typists and private tutors) or to those who combined farming and agricultural labour.

Though the highest level of education received by women was secondary, most had only attained a primary level. During the study most women were in their second pregnancy (see Table 4, facing page).

Women played significant roles in therapy management of pregnancy child-birth and postpartum; a pregnant woman would often manage her own therapy as her mother or mother-in-law

TABLE 2

Occupation of Husbands Among Subsample Cases (n=34)

Occupation	Per cent
Business/service	38.2
Farming + agricultural labour	32.3
Farming only	11.8
Fishing	11.8
Agricultural labour	5.9

TABLE 3

Highest Education Attained Among Subsample Women.

Education Level	Per cent (n=34)
Secondary	14.7
Primary	41.2
None	23.6
Maktab (informal religious)	20.5

TABLE 4

Current Pregnancy Among Subsample Women (n=34)

Pregnancy no. (gravida)	Per cent
1	20.5
2	26.5
3	14.7
4	14.7
5	2.9
6	16.7
7	2.9

would have done *(sasuri)*. Shifts in control of therapy emerged at three points in the reproductive process: pregnancy, labour and postpartum. Further, families employed the range of therapy options available using more than one choice if the problem persisted, or if the therapy seemed inappropriate. Although most complications were minor, serious and life-threatening conditions did occur.

2. 1. Pregnancy

The majority of women (61.8 per cent) suffered only minor ailments during pregnancy. Sometimes discomfort from minor problems, such as dizziness *(matha ghura)* or constipation, would be treated by diet change, water on the head or other home remedies. Other women received treatment by a *kobiraj*.

This is consistent with Blanchet's (1984) findings; people fear the use of medication during pregnancy for the possible effects on the unborn child. However, the data also reveal that in certain circumstances people do employ therapists who will provide allopathic medication.

In five cases, a village doctor was called to treat problems, such as fever, sore mouth *(mookher ghao)* and diarrhoea. Three families obtained the services of a nurse midwife (from ICDDR,B).

Thus, it appears that families accept the use of medication for medical problems which may interfere with the wife's ability to work or fulfill her responsibilities. If allopathic medicine is acceptable in certain instances, opinions within the household may vary as to when this treatment is appropriate.

For example, one woman related that although her mother-in-law, a TBA, did not approve of medication use during pregnancy, she felt that drugs were acceptable for relief of discomfort. As a result, she reported the problems to her husband who obtained

CONTINUED...

Therapy Management and Reproduction

treatment for her. Another young wife successfully convinced her husband to bring medication for her lingering upper respiratory ailment, despite his mother's objections.

The difference in opinion between young wives *(bow)* and mothers-in-law may partially explain why women often reported that either she (in seven cases) or her husband (seven cases) were primary decision-makers.

The husband's role in therapy management during pregnancy is an indication of the dependent position occupied by a wife within the extended and nuclear family. Even though a woman may decide what treatment she needs for a problem, if the therapy entails resources beyond the household or *bari,* or if it requires payment, usually she must secure the agreement and cooperation of someone else like her husband, mother-in-law or mother.

This dilemma was expressed by a woman in her fifth month of pregnancy who suffered generalized aching for over a week. She asked her husband to obtain medication for the problem but he said nothing and did not act upon on her request.

The role of gatekeeper played by the husband, his mother or another higher ranking family member is apparent in situations where the woman may need to leave home for treatment:

In the third trimester of her second pregnancy, Delu* complained to the CHW about swelling and headache. The CHW then informed the midwife who made a home visit and diagnosed pre-eclampsia. The nurse midwife advised the husband to bring his wife to the health subcentre for further assessment, but the husband refused. Instead he provided homeopathic medication for his wife who delivered a few weeks later without problem.

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Therapy Management and Reproduction

*All names used for Matlab women in this article are pseudonyms

Delu later related that she had successfully taken homeopathic medicine for the same problem in her first pregnancy.

Delu's explanation is significant because the preference for in-home treatment reflects gender ideology (attitudes about behaviour, work and mortality) and, as we explore later, economic demands upon the household.

Typically, families implement home-based treatment because it is less disruptive to the family and is consistent with attitudes about proper behaviour for women. Regarding the use of homeopathic medicine, previous successful treatment with one medicine for the same problem reinforces the family's confidence in homeopathy.

Consequently, there is no advantage for the family to expose an expectant mother to the peril and loss of modesty resulting from a thirty- to forty-minute walk to the health subcentre located beyond the bazaar, a place of particular risk. Therefore, it follows that Delu's husband denied her permission to travel to the subcentre. Incidentally, in this particular case, the medical recommendation for pre-eclampsia is bedrest.

Permission for treatment outside the home is not always denied to the ailing mother as the following case indicates:

Rufia*, 24 years old in her fourth pregnancy, had a history of miscarriages. The nurse midwife visited Rufia as a high-risk patient and advised her *sasuri* to call if any problems developed with the pregnancy. Later, in what Rufia believed to be her eighth month, her membranes ruptured without labour pains.

A *dai* in the same *bari* checked Rufia and said she could do nothing. The *sasuri* then notified the nurse midwife who realized that Rufia had an intra-uterine death, and would require

medication to initiate labour. When the midwife recommended transfer to Matlab for care, the *sasuri* readily agreed and accompanied her daughter-in-law to Matlab, leaving a younger daughter-in-law in the home to work.

The occurrence of a rupture of membranes without labour in one of the daughters of another family initiated a call to the nurse midwives, but with different results: Nilufur*, a 35-year old woman in her sixth pregnancy, lived with her husband, *sasuri* and their three children. Her *sasuri,* elderly and frail, was also her husband's step-mother, and as a result, did not figure in decision-making.

Six months of the year Nilufur's husband worked in a sugar mill in Rajshahi; therefore Nilufur, in addition to household duties, was household head six months a year, during which time she supervised labourers who planted the important cash crop, potatoes. During the potato season Nilufur, then full term, developed ruptured membranes.

When she had no labour by the next morning, her mother (visiting to assist during her daughter's confinement) called the nurse midwife. The midwife observed Nilufur for several hours, noted meconium stained amnionic fluid, and finally recommended transfer to Matlab when labour never began.

A long period of discussion followed while the the decision was made. The mother as therapy manager, refused transfer and called her son, a village doctor, to provide treatment for his sister. He used homeopathic medication to initiate labour and later that night Nilufur delivered without problem.

Nilufur's mother was therapy manager, since no one else could take the responsibility, and as such she employed another therapy option in order to keep her daughter in the home for delivery. In that way, both she and Nilufur could supervise labourers and carry on domestic responsibilities.

Nilufur and Rufia's cases illustrate the shift in control of therapy management in pregnancy when serious conditions arise. In each case control went to the mother or *sasuri,* a shift typical in management of labour and delivery.

2. 2. Labour and Delivery

Among the 34 cases analysed, 29 delivered during the research period. Among those who delivered, 27 delivered in the study villages and all but one family called a *dai.* One visiting mother-in-law happened to assist a woman in delivering a premature infant, though she does not practise in this community.

Of the 27 families, 44 per cent called a relative. Of those, 67 per cent were close relatives (mother-in-law or mother) and 33 per cent were distant relatives (husband's uncle's wife, for example).

The birth attendants were post-menopausal women who varied in level of expertise, experience and extent of their midwifery practice. While the TBAs' delivery techniques entailed unsafe practices — cervical massage, frequent vaginal examination, poor hand washing — some TBAs possess skills in dealing with complications during delivery.

One *dai*, also a *kobiraj*, was known and respected in the community. On two occasions during the research she was called when delivery complications arose. In one instance, the first TBA was unable to deliver the infant and, another time, the *dai* removed a retained placenta when the nurse midwife was unsuccessful. Both complications are discussed below.

Complications or problems were reported in six of the 29 deliveries. Of the complicated cases, five were experiencing their first delivery and all five reported prolonged labour, although none of them reported labour lasting more than 15 hours.

CONTINUED...
Therapy Management and Reproduction

Two families did not treat "prolonged labour", whereas three families attempted to accelerate the process. One family used homeopathic medicine to strengthen contractions and two families called the nurse midwife. Of those two cases, one delivered before the midwife arrived.

The third case proved to be more complicated. The husband, an apprentice village doctor, reported to the anthropologist that he called the nurse midwife when his wife's labour pains remained ineffective. He supervised the administration of intravenous medication, with the help of the nurse midwife, to stimulate his wife's labour. The midwife no doubt felt that she could provide a safer administration of the drug than could the young husband.

This case, in contrast to decision-making in pregnancy, was the only instance in which the husband decided on and directly involved himself in the treatment of labour complications. The remaining cases were decided by the mother of the labouring woman (in three cases) and the mother-in-law (in two).

Seven women, four of whom were primiparous, experienced complications during delivery. Of the complicated deliveries, three reported prolonged delivery of the placenta, one experienced retained placenta (with subsequent postpartum haemorrhage), and three others had "difficult" deliveries.

CONTINUED...
Therapy Management and Reproduction

In two of the difficult deliveries, the TBA was able to deliver the infant; however, one *dai* was unsuccessful, so the mother-in-law called another *dai* who successfully delivered the newborn.

The infant, however, died four days after birth. The mother-in-law had called a *kobiraj* to treat the baby on the third day.

In one of three cases, the TBA removed the placenta manually solving the problem of prolonged delivery. Another case resulted in postpartum haemorrhage and will be discussed below. Thus, the mother-in-law acted as therapy manager in two cases requiring services beyond the services of the TBA. The senior women in the household experienced in the birth process also control therapy management of serious postpartum complications.

2. 3. Postpartum

A life-threatening complication developed in one case of postpartum haemorrhage:

Assiya, a 37-year-old gravida 7, para 8 (earlier twin delivery) developed retained placenta and began to bleed heavily after delivery. Her mother-in-law and *dai* sent for the nurse midwife who arrived to find four large rice sacks, a sari and the floor completely saturated with blood. The parturient was still bleeding heavily.

Unable to remove the retained placenta, the nurse midwife recommended transfer to Matlab, but the husband and the mother-in-law would not permit it. The husband agreed to send his wife if his mother supported the transfer, but the mother-in-law expressed the fear that if she gave permission and her daughter-in-law died, the wife's family would blame her. Both the mother-in-law and the husband reported that they had no money for treatment or travel expenses to Matlab.

The transfer abandoned, the midwife left and the family called another *dai* who successfully removed the placenta and stopped the bleeding. The nurse midwife returned later that day and provided antibiotics and iron tablets. Nevertheless, Asia subsequently developed a postpartum infection and the midwife again urged transfer, but the family again demurred. The husband reiterated their financial problems concluding that his

wife had a certain number of days on earth and when they were used she would die. Continuing antibiotic and iron therapy at home, Asia remarkably survived her postpartum complications.

Two other women reported heavy bleeding. The village doctor provided medication to one woman for weakness resulting from excessive blood loss, while the other relied on rest for her recovery. The village doctor also treated a woman suffering from fits or tremor *(khichooney)*, and diarrhoea following delivery.

However, the most common complaints reported were (in eleven cases) minor and included postpartum pains. Six received treatment, either from the village doctor (in three cases), the CHW (in two), or the nurse midwife (in one).

Of those treated for postpartum complications, two new mothers obtained treatment directly from the CHW and two others told a family member what treatment to obtain. Husbands decided therapy in four instances. A mother and a mother-in-law decided treatment in only one case each. Thus, during the postpartum period wives again exerted more decision-making ability for less serious problems. The husbands played a significant role in choosing treatment for serious complications.

3. DISCUSSION AND CONCLUSIONS

3. 1. Therapy management :

Generally, women (parturients and their female kin) played significant roles in decision-making throughout pregnancy, delivery and postpartum. Wives in the subsample exerted more control (often indirectly) over therapy management during pregnancy and postpartum with less serious conditions, but were dependent upon other household members to obtain treatment outside the household. Indirect control exerted by women in questions of reproduction take several forms including gossip (Browner 1986) or solitary delivery (Sargent 1982a, 1982b).

The women in this study would circumvent an un-cooperative mother-in-law when possible and make requests for medication or extra food to their husbands who were more willing to appease their wives. Nevertheless, not all husbands are sympathetic to the needs of their wives who then suffer the results of differential access to health care.

Since men control access to resources found in the market, wives must rely upon the willingness of their husbands to provide treatment. Consequently, in-home treatment for young women is of great significance as a source of direct access to medical resources and greater independence.

As the data show, women are social actors who use formal and informal means to obtain treatment for their medical problems during pregnancy. Once in the labour and delivery phases however, senior women control therapy.

Therapies employed by women or men included all of those available in the village. Pregnancy complications were treated by the village doctor, nurse midwife, *kobiraj* or by a home remedy. Treatments during labour included homeopathic medicine and nurse midwife services. Delivery complications were solved by TBAs. During the postpartum period, the village doctor, nurse midwife and CHW were consulted.

Thus the skills of the ICDDR,B nurse midwife were employed throughout the reproductive process; however, their treatment plan was rejected at what health planners view as critical points in therapy management during labour and delivery.

On three occasions a mother or mother-in-law called on the nurse midwives. In each case the nurse midwife recommended transfer

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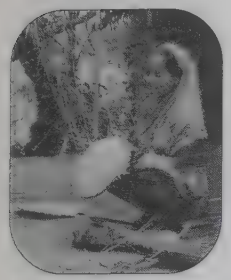
Therapy Management and Reproduction



for further treatment, but in two cases the family refused. When transfer of the ailing woman was considered, therapy management expanded to males when they were available in the home.

Although in most instances within the sample women made the decision about transfer, three previously observed cases of recommended transfer not included in the sample involved male family members. In these instances, the senior female, either mother or mother-in-law, deferred the decision to the male.

Nevertheless, if men are not in the home, the senior female will make decisions about transfer as in the two cases cited here. Decisions by families regarding the transfer of gravid women with complications raises essential questions about the decision-making process which, in turn, determines the success of the nurse midwife's programme.

3. 2. Therapy Options and the Nurse Midwife

The nurse midwives provided services to ten women in the subsample and two additional cases, who were not included in the original subsample, were observed. Two families requested their services for normal deliveries, whereas two families (one observed) called for prolonged labour. Both delivered before the midwife arrived, indicating the need for improved communication between TBAs and nurse midwives and continued TBA training. Three families called the midwife for ruptured membranes without labour (including one observed case) and one for postpartum haemorrhage.

In four instances (two referred by the CHW and two referred by the anthropologist with family permission) midwives assessed pregnant women for possible complications. In addition to these ten referrals, two newborn babies not included in the subsample received services from the midwife.

These findings confirm a general community acceptance of the nurse midwife as a therapy option for complicated pregnancy cases, a perception promoted in the village by the midwives. Moreover, among some families the nurse midwife is viewed as a practitioner superior to the village *dai* to be called for important uncomplicated deliveries.

In addition to the two families who called for nurse midwife services for uncomplicated childbirth, another family who called the midwife for a complication also considered this option for normal delivery. All three parturients were primiparous. Another woman remarked that the TBA possessed skills for normal delivery, but the nurse midwife was capable of treating complicated deliveries.

Thus, community perception is varied but, generally, the nurse midwife is viewed as a higher level practitioner who possesses greater skills and medical resources, such as medications or intravenous fluid.

The expertise and resources possessed by the nurse midwife, however, represent a threat to some TBAs. One TBA would become angry if the family called the nurse midwife and would make a show of leaving the delivery room once the nurse midwife arrived. The nurse midwife would call to the disgruntled *dai* requesting her to conduct the delivery. Her respect and position restored, the *dai* would return to deliver the infant. Although the nurse midwife handles these situations well, the disparity of resources between the two practitioners is clear and the TBA remains threatened by the nurse midwife.

Among the cases cited above, midwives advised care outside the home or transfer to Matlab in *seven* instances, but families agreed to the transfer in only *four* instances. Various factors interact to shape decisions for or against transfer: previous

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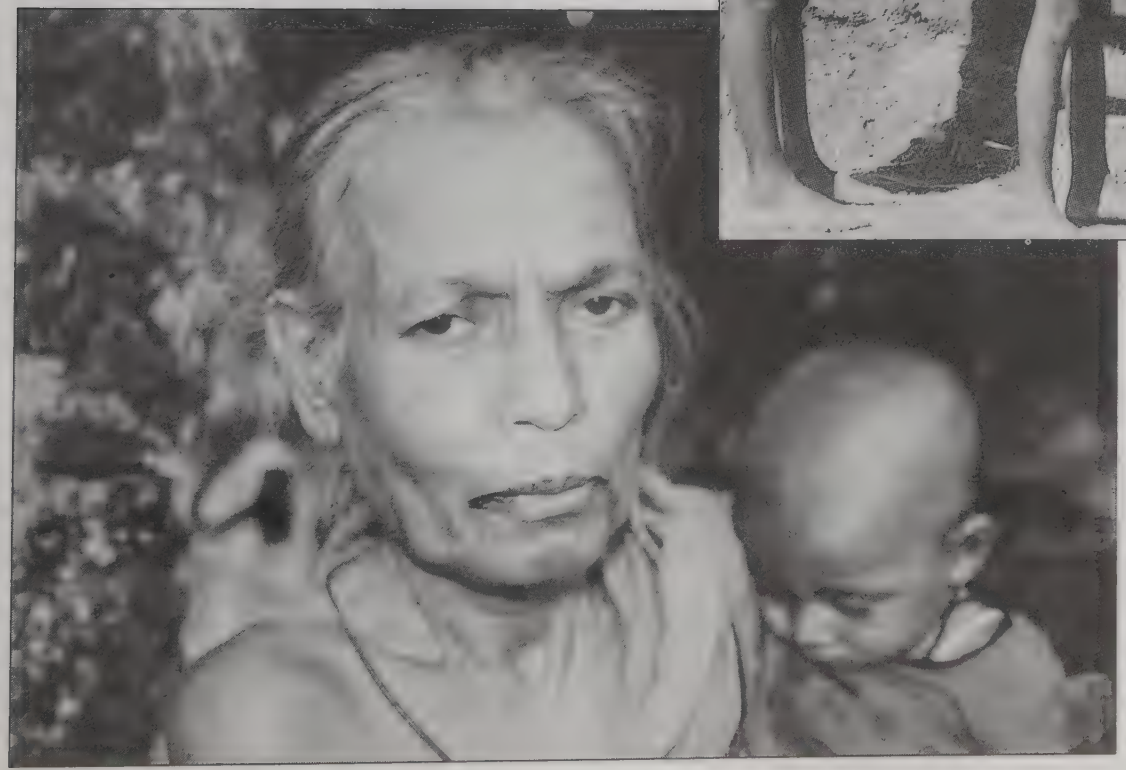
Therapy Management and Reproduction



The children above are among the lucky ones whose mothers experienced safe labour and childbirth. They are in good health and, as they grow up, they learn to enjoy taking care of each other.

For the very young, there's always grandmother or an elderly member of the bari in whose arms plenty of affection is to be found.

experience of service, perception of service, fear of illness or death, fear that the woman may be touched by a male health care worker, or concern for the opinion of the wife's family. A common reason given by families for refusing care beyond the homestead was the woman's domestic work responsibilities.

To fully appreciate this reason, we must recall the role expectations and status of women within the family. Economic realities in Bangladesh frequently force families to allocate scarce or inadequate resources and since women are viewed as economic burdens, their needs are given lower priority than income-earning males. Despite this, work expectations placed on women are high.

Informants related that the good *bou* (or wife) eats little, works hard, and makes few requests to her husband. In this way she brings fortune to the family. Thus women are expected to work throughout pregnancy and up to delivery.

Bleeding during pregnancy or such symptoms as those of pre-eclampsia are not recognized as problems requiring rest. In fact, rest and increased diet during pregnancy are thought by many to increase the infant's head size and make labour and delivery more difficult.

CONTINUED...
Therapy Management and Reproduction

Moreover, women, recalling their deliveries, often reported that they first finished all of their domestic work — cooking, cleaning and so on — and then had their baby.

Kajol, a primipara, reported that the day her labour began, she had forgotten to make bread in the morning and had been chastised by her mother-in-law for shirking her responsibilities because she was expecting. In anger she worked silently throughout the day while in labour completing all her work before she hinted to her husband at bedtime that she had pains.

Clearly, reproductive beliefs held by women and their families reflect a gender ideology which places high value upon female productivity with little demand upon the household.

Further, there is no differentiation of priority between reproductive and productive efforts. Whereas outside observers may separate, and according to Browner (1989) "...(attribute) primacy to either productive or reproductive processes,... in reality the two are one single process and should be analysed together."

Nilufur's case illustrates this point most clearly. As household head, she was responsible for completing her reproductive labour, but also maintaining the domestic sphere in addition to economic demands of potato planting.

Though Nilufur could not move outside the birthing room, she was capable of conducting business through her mother. Transfer from the home would have required Nilufur's mother to accompany her, thereby leaving the house without adult supervision and would have entailed additional travel and, possibly, hospital costs. For this landowning family and other households, insufficient human and financial (labour and monetary) resources places the women at a disadvantage.

Families seek health options which permit the household to meet all economic and labour demands; therefore, transfer may seem a radical early step in a setting of medical alternatives. An experienced TBA may solve the problem, as in Asia's case, or a village doctor may treat women in the home and accept partial payment initially. In other words, transfer which is costly to the household is not a first option for the family given the availability of alternative in-home therapies.

In sum, the reproductive decisions made by families reflect an interaction between gender ideology, specifically the role expectations and status of women within the household, and economic demands and constraints upon the family in terms of either monetary or labour resources.

Key decision makers for problems of pregnancy and child-birth included both men and women, although shifts in control of decision-making occurred between pregnancy, labour, delivery and postpartum.

Key therapy managers in pregnancy were the women suffering the ailment and their husbands. Husbands and mothers-in-law filled the role of gate-keeper in obtaining therapeutic resources beyond the household.

During labour and delivery, mothers-in-law, mothers, or another senior female (possibly an older sister-in-law) assumed responsibility for therapy management, often sending husbands out to obtain medicine or therapists. During the postpartum period, again it was the wives and their husbands who most often assumed control of the decision-making.

In circumstances where nurse midwives were called in and the question of transfer arose, men (when available) controlled that decision; although, as this study demonstrates, mothers and mothers-in-law figured significantly in decision about transfer.

The decision to transfer is influenced by considerations of appropriate behaviour for the pregnant woman (seclusion) and economic demands upon the family. Economic considerations include the loss of valuable female labour (particularly in landowning families) and a shortage of money.

These findings present implications for maternity care services offered by the MCH-FP project through the nurse midwife programme and for further research.

On the following pages are recommendations based on the findings. ■

Acknowledgements: This research was made possible by funding through the Fulbright Foundation and the MCH-FP Project of ICDDR,B. Assistance with this work by the following people is gratefully acknowledged: Dr Vincent Fauveau, Dr Joan Stevenson, Dr Carolyn Sargent, Dr Kate Stewart, Dr A. de Francisco and Tom Stark, Capt.,USN.

Although the traditional society had arranged for the assistance of traditional birth attendants in home deliveries, the high maternal mortality prevailing in rural Bangladesh required an assessment of the roles of midwives and community health workers in maternity care.

CONTINUED...
Therapy Management and Reproduction

CHAPTER 18

Therapy Management and Reproduction in Matlab: Trained Nurse Midwives as an Option

Nancy Stark, Rehana Akhter, KMA Aziz & J. Chakraborty

Conclusions and Recommendations:

Re-evaluate the policy for transfer of complicated cases.

Assess and prioritize conditions requiring treatment outside the home and examine ways in which certain medical problems can be treated through health subcentres requiring short-term in-patient stays or outpatient day care (perineal lacerations requiring repair, for example). The subcentre is more accessible to families and provides a more suitable health option than a transfer to Matlab, which is farther away.

Expand the teaching role of the nurse midwife.

The nurse midwife can work with the TBA on certain prenatal and postpartum complications in addition to deliveries. The village TBA is a prime care provider for child-birth and possesses a range of expertise, as the data revealed. The TBA is used for or at least consulted about certain complications associated with delivery.

Since the nurse midwife works with the TBA during delivery, often supervising her delivery techniques and practices, her role could be expanded to include complications of pregnancy and delivery. Not only can the nurse midwife use these opportunities to teach both the family and the TBA, but the nurse midwife can allow the TBA to demonstrate her skills and expertise. In this way the nurse midwife can improve her relations with the TBA.

The nurse midwife can emphasize her teaching during home visits to key female decision makers in two areas: 1) the value of women s labour to the economic survival of the household and, therefore, the need to preserve the health of women, and 2) medical conditions of pregnancy and child-birth which require medical attention.

Home visits offer the nurse midwife the opportunity to teach families about pregnancy including the signs and symptoms of complications especially bleeding, miscarriage or pre-eclampsia, normal labour, rest and diet, and female reproductive physiology. She may do this within the context of the woman s valuable role in the family as a child-producer as well as an income producer.

Evaluate alternative therapies available in rural areas for efficacy and safety, particularly less aggressive ones.

One frequently employed therapy is homeopathic powder to initiate or establish effective labour. This medication is both less expensive and less aggressive than the standard biomedical treatment of oxytocin infusion. Further, although women reported successful use of the medicine, no negative side-effects were reported or observed. Thus, research into efficacy and safety would be of value in the treatment of ineffective labour.

The maternity care programme should plan to extend the education effort within the community to males in general and to village doctors in particular.

Males are significant decision-makers for the treatment of women s reproductive problems. The village doctor is a key resource employed by rural men for reproductive problems of men and women alike. As such, men in general and village doctors in particular are important targets for education in the treatment of pregnancy and child-birth complications and in the safe use of medications. Further, educational efforts should focus on the importance of the women s contribution to the economic survival of the household.focus on the importance of the women's contribution to the economic survival of the household.

Education efforts of the home-based maternity care programme should incorporate the idea of women as significant contributors to the economic survival of the household, whose good health is of benefit to the well-being of the entire family.

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CHAPTER 19

Socio-economic and Demographic Correlates of Child Health and Mortality in Matlab

Abbas Bhuiya
Stan D'Souza

In recent years there has been an increased interest in mortality studies in general and child survival issues in particular. High infant and child mortality are usually associated with poverty and efforts have been made to develop frameworks within which the factors underlying mortality can be examined. Socio-economic and biological correlates are studied, although models of increasing complexity are proposed to cover, for instance, structural and environmental variables (Mosley and Chen, 1984).

The problem with these models for the developing country situation is that appropriate data are not available. Vital registration systems, if they do exist, rarely provide data of reliable quality.

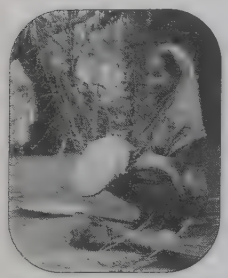
It is against such a background that the Demographic Surveillance System (DSS) of the field station of the International Centre for Diarrhoeal Disease Research, Bangladesh (ICDDR,B) in Matlab has achieved world-wide recognition.

The DSS has been in operation since 1966. It has included the registration of births, deaths and migration into the area since its inception and has been complemented by periodic censuses. The 1974 and 1982 censuses included the collection of socio-economic-status (SES) data. Some data on structural variables were also collected at the 1982 census update.

The combination of the longitudinal registration of vital events over an extended period with the socio-economic data collected has provided a unique opportunity to study child survival-related issues.

The scope of such studies, if DSS data alone is used, is limited to those included in the regular data collection and periodic censuses. For example, topics, like levels and trends of child mortality by correct age of children, can be investigated from the data generated through the regular system. Associated maternal demographic factors, such as age, parity, birth interval, previous child-loss experience of mother and sex of children, can also be studied from the DSS data alone.

Part III



Study of the socio-economic determinants of child survival is also possible by linking the census data with that of the registration data.

Since data on nutrition, morbidity, health care and hygiene are not normally included in the registration forms, a study of these factors in most cases necessitates field work outside DSS.

However, DSS facilitates such studies by providing a sampling frame. It also provides an opportunity to follow the study subjects for their survival and migration.

Prior to the internationalization of the ICDDR,B in 1979, data processing of Matlab data was done at the Johns Hopkins University in the United States. In fact, it was only after 1979 that an IBM System 34 minicomputer was acquired for the DSS in Dhaka under a UNFPA grant.

The analysis of mortality and other data obtained from studies carried out in Matlab began to be done in Bangladesh only after this acquisition and the training of local staff. Linkage of vital statistical data with socio-economic variables was a difficult task carried out on more powerful computers outside the ICDDR,B. The limited facilities restricted the scope of analysis which was mainly univariate under the circumstances.

CONTINUED...
Socio-economic and Demographic Correlates

The improved computer capacity now available at the ICDDR,B itself has made it possible to study increasingly complex correlates of mortality and child survival. Institutional linkages with the Australian National University has allowed for the training of staff and made available large computers for the study of Matlab data through multivariate analysis.

Of equal importance was the introduction of a dual numbering system during the 1982 census update to allow for the creation of a database environment, where linkage of files was facilitated. This contrasted with the cumbersome system developed at Johns Hopkins and dubbed the "yeti". The scope of this paper is restricted to child mortality-related issues.

Over the years, many investigations on child mortality-related issues have been carried out in Matlab. They broadly fall into three categories: description of levels and trends, identification of socio-demographic and economic correlates and investigation on proximate determinants.

The figures on levels and trends of childhood mortality, with the precise age of children, have been the direct result of the DSS, based on complete, higher quality registration data.

DSS is the only source in this country from which a reliable picture can be obtained of the demographic situation over a long period of time.

The extraordinary quality of the DSS data, and its unique field operation system, has made other studies on child survival possible covering a diverse area to augment our knowledge on the subject. An attempt will be made in this paper to take stock of the knowledge acquired from Matlab in the field of child survival, to identify the gaps in knowledge and to indicate future needs.

1. SOCIO-ECONOMIC AND DEMOGRAPHIC CORRELATES OF CHILD MORTALITY

A good number of studies used data generated from Matlab DSS and periodic censuses to identify socio-economic correlates of childhood mortality. A summary of some of these studies will be of help to assess the current level of knowledge on the subject.

1.1. Socio-economic correlates

The first attempt to identify the socio-economic correlates was made by D'Souza and Bhuiya (1982) by combining the DSS registration data with those of the 1974 DSS census. Yearly

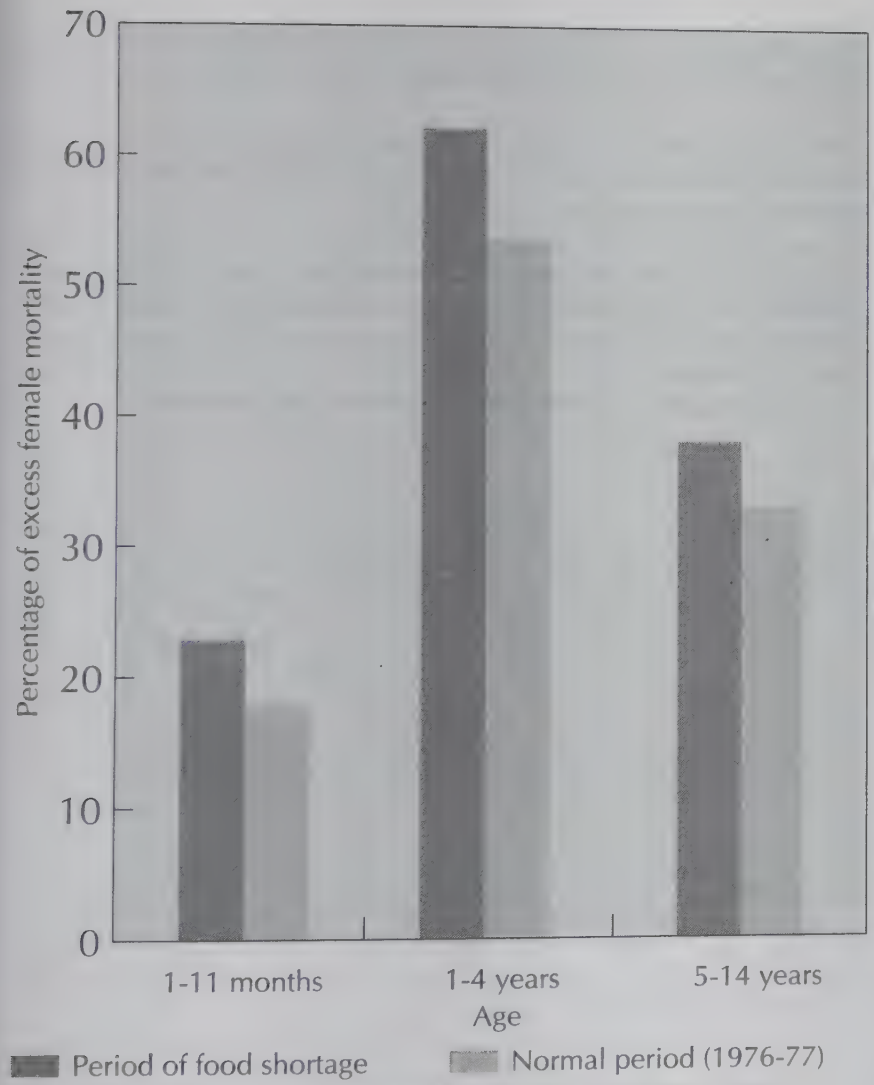


Fig 1: Percentage by which female mortality rates exceeded male mortality rates in infancy and childhood during a period of food shortage (1974-75) and during normalcy (1976-77), Matlab, Bangladesh

Source: D'Souza er al (1988)

mortality rates classified by parental and household characteristics were calculated for 1974 to 1977.

The variables included to represent various aspects of household and parental socio-economic status were education of household head, highest level of education achieved by any household member, education of mother, occupation of household head, size of dwelling, ownership of cows and possession of a fixed toilet.

Child mortality was observed to be negatively correlated with household and parental socio-economic conditions.

However, the relationship was most prominent in the case of maternal education: children of mothers with no education had a mortality rate five times higher than those of the mothers who had completed seven or more years of secular schooling. The positive impact of maternal education on survival during infancy with data on a relatively small number of subjects from the mid-1970s was also demonstrated by Chowdhury (1982).

1.2. Sex differentials

The issue of sex differentials in childhood mortality was addressed in two studies using DSS data from the mid-1970s. One of them used cross-tabular analysis and reported that during the neonatal period male mortality was higher than female but after the neonatal period the pattern was reversed (D'Souza & Chen, 1980). The consequences of extreme privation for sex differentials in mortality can be examined in times of crisis.

In Figure 1 (left), the percentage of "excess" female death rates in comparison to male death rates is shown during the food shortage of 1974-75 and during normal years 1976-77. For three critical age groups (1-12 months, 1- 4 years and 5- 14 years), "excess" mortality was consistently higher during the food shortage years.

This would indicate that female children suffer disaster disproportionately. Scarce resources are allocated more readily to

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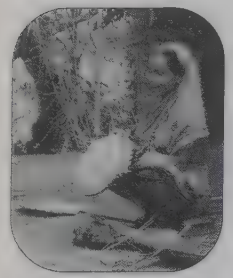
Socio-economic and Demographic Correlates



boys than girls. A food allocation study, referred to later, documents this point.

A similar picture was also observed by Koenig and D'Souza (1986). In their longitudinal study, a cohort of infants born between May 1, 1973 and April 30, 1974 were followed up till April 30, 1978. Cumulative life-table probabilities were established. Probabilities of mortality by sex for the cohort of 11 454 infants born during 1973-74 were calculated.

Males were observed to experience higher mortality during the first month of life; after that cumulative rates for females exceeded the rates for males and this differential grew progressively wider over the course of early childhood.

Matlab field station provides a unique opportunity to examine the interaction between health intervention programmes and sex differentials in mortality.

The area is divided into two: the Maternal and Child Health-Family Planning (MCH-FP) area and comparison area, the MCH-FP area being supplied with intensive family planning and MCH interventions and the comparison area being provided these facilities at a lower level, as available under the usual government programmes.

CONTINUED...
Socio-economic and Demographic Correlates

SES 1982
ICDDR, B

1. Card No. 1 (1), 2. Study No. _____ (2-4), 3, Village: _____ (5-7), 4. Bari: _____ (8-10)
5. Family No. _____ (11-14), 6. (74/) Family registration No. _____ (15-18), 7. Religion: _____ (19), 8. Date of interview: _____ (20-25)
9. Main sources of water during Season (from to) :
Drinking: _____ (26), Cooking: _____ (27), Bathe: _____ (28), Washing: _____ (29)
Codes: Tube well (1), Tank (2) River (3), Ditch/Canal (4), Other (5)
10. Sturcture of the largest room: Wall: _____, Roof: _____ (30)
Codes: Wall tin + Roof tin (1), Wall pucca + Roof tin (2) Wall tin + Roof others, Wall others + Roof tin (3),
11. Items owned : Lep (01), Hurricane (02) Bicycle (04) Any watch (08), Radio (16), Remittance (32) _____ (31-32)
12. No. of cows owned: _____ (33), 13. No. of boats owned: _____ (34)
14. Total land owned (excluding homestead) in decimals: _____ (35-38)
If own land: Self cultivated (1) renting out (2) _____ (39) Share cropping (4)
If no land: Takes rent (1) Shares crop (2) _____ (40) Other (Specify) (4)
15. Use of fixed latrine: Male Yes/No _____ (41), Femel Yes/No, Within 15 yards from used water sources: Yes/No _____ (42)
16. Highest education of former member now outside DSS/Abroad: _____ (43), Type: _____ (44), Years of schooling: _____ (45-46)
17. Highest education in family: Type _____ (47), Years of schooling: _____ (48-49)
18. Occupation of household Head: _____ (50-51), 19. Family size: _____ (52-53)

Fig 2 : Sample Questionnaire

This arrangement provides an opportunity to assess the importance of free health services in reducing sex differential in survival.

An examination of childhood mortality trends of male and female children in the MCH-FP and comparison areas since the inception of the programme revealed that the male-female mortality gap is relatively narrower in the MCH-FP area than in the comparison area. However, the female disadvantage is yet to be eliminated from the MCH-FP area.

1.3. Socio-demographic correlates

A comparison of the 1974 and 1982 SES data, collected with similar questionnaires (Figure 2, facing page), has indicated that though the socio-economic picture of the Matlab area had not appreciably worsened there were few if any signs of improvement in the lot of the people (D'Souza, *et al.*, 1990).

An examination of the structural variables collected in 1982 indicated important structural differences between the MCH-FP and comparison areas. A review of the rationale for the delineation of the two areas should be made.

It may be mentioned that the above studies were mainly univariate in nature, consequently the observed association was gross, and the net effects of the independent variables on survival in the presence of the others could not be ascertained. In addition, no attempt was made to explore the nature of interaction effects that the independent variables may have on survival.

Against this background, subsequently, an attempt to identify important socio-demographic correlates of childhood mortality was made by linking the 1982 birth cohort of the whole Matlab population with the 1982 census information.

A cohort of 7,363 live-births was followed until December 1984, and a multivariate analysis was carried out to examine the net effects of the covariates on mortality. The covariates included in the study represented various characteristics of the household, of the mother and of the children. The variables included in the analysis to represent household socio-economic status were:

(a) amount of land owned,

(b) ownership of specific items,

(c) occupation of household head,

(d) household size,

(e) religion,

(f) education of mother,

(g) per capita dwelling area available in the household,

(h) sources of drinking water, and

(i) possession of a fixed latrine by the household.

The analysis was carried out with both a main effect model and a model with interaction effects. Results from the main effect model showed that among all the above-mentioned variables ownership of items, health programme status, maternal age and education, sex and birth order of children were found to have significant relationships with child mortality when the age of the children was controlled. In addition, it was observed, on the basis of results from models with interaction effects, that the effects of the sex of children, health programmes, age of mother and birth order were found to be dependent on the age of children (Bhuiya, 1989; Bhuiya & Streatfield, 1992). A summary of the results obtained through the multivariate analysis is presented below.

CONTINUED...
Socio-economic and Demographic Correlates

A street in Matlab Bazaar: the big pots contain milk products.

Besides rice and jute cultivation, fishing is one of the main activities along rivers and canals in Matlab.

1.3.1. Main effects of the covariates

Socio-economic factors

The relationship between child mortality and the economic status of household measured by **ownership of articles** was a curvilinear one: *children from the poorest households experienced the highest risk while the middle class experienced the lowest.* Children from the poorest class had 1.14 times higher odds of dying than the richest when the effects of other variables were held constant.

Education of the mother showed a consistent pattern of negative relationship with child mortality when the effects of other variables were held constant. Children of mothers without any schooling were found to have the highest odds while those whose mothers had more than six years of schooling had the least odds of dying. In a comparative sense the children of the former group had 1.86 times higher odds than the latter.

Gender was found to matter for survival of children. When the effects of other variables were controlled the female children experienced 1.18 times higher odds of dying than males.

Demographic factors

Maternal age of mothers demonstrated a consistent pattern of negative relationship with child mortality when the effects of other variables were controlled. The higher the age of the mother, the lower was the risk of mortality of children. The odds of dying for children of mothers aged less than 20 years were 1.65 times higher than for those whose mothers were more than 29 years old at the time of birth of the child.

The association between live *birth order* and *child mortality* was curvilinear in nature: the first order births experienced the highest risk, then it went down for the order 2 to 3, and 4 to 5, and then increased again for the birth order six or more.

MCH-FP programme

When the effects of other variables were held constant, children from the blocks with intensive MCH-FP programmes were found to have the lowest risk of death compared with the children from the less intensive MCH-FP area and the comparison area.

The children from the comparison area had a 40 per cent higher odds of dying than those from the intensive programme area.

1.3.2. Interaction effects of the covariates

Sex and age of children

It was observed that the sex pattern of mortality was not similar in all groups. In other words, the higher mortality among the female children, as could be discerned from the main effect model, varied in nature with the age of children.

For the first five months of life the male children had a somewhat greater risk of dying than the females and afterwards the pattern was reversed with a widening of the differentials.

Maternal age and age of children

It was found that the impact of maternal age on childhood mortality was different in various age segments of the children's lives. In the neonatal period the risk for the children of mothers aged less than 20 years was almost twice that of the mothers aged over 20. During the post-neonatal period the importance of maternal age was almost invisible. After the post-neonatal period children of mothers aged 30 years and over had the lowest risk of death, while the children of mothers aged less than 20 had the highest risk at 12-17 months and second highest at 18-35 months.

Birth order and age of children

For birth order, the first order births were found to experience the highest risk during the neonatal period, and the sixth and higher

CONTINUED...
Socio-economic and Demographic Correlates

order births were found to have the highest during 18-35 months of age. The children of middle birth orders maintained almost a similar risk in all age groups.

MCH-FP programme and age of children

The impact of the MCH-FP programme on child survival was also found to be dependent on the age of children. During the neonatal period the children from the comparison area were found to have the highest risk while those from the less intensive blocks had the lowest.

There was no impact of the MCH-FP programme on survival during post-neonatal period. However, after the post-neonatal period the impact of the programmes on child survival was clearly marked.

Maternal education and sex of children

The effect of maternal education on childhood mortality was found to be dependent on the sex of children. It was observed that with an increase in maternal education from no schooling to primary level the decrease in risk of death was greater for the boys than the girls. The risk of death of both sexes had a tendency to converge when the mothers had more than primary schooling.

CONTINUED...
Socio-economic and Demographic Correlates

The above pattern of interaction effect of maternal education and sex of the children was further explored by analysing children aged six months and above using a multivariate logistics regression technique.

It was revealed that for boys a change in maternal education from no schooling to 1-5 years resulted in a reduction in the predicted risk of 45 per cent while for girls it was only 7 per cent.

Similarly, a change in maternal education from no schooling to six or more years of schooling reduced the risk of dying 70 per cent for boys, but only 32 per cent for girls.

Variation in reduction of the risk of dying as maternal education increased from 1-5 years of schooling to six or more was also observed: it was 45 per cent for boys and 27 per cent for girls. The risk ratios between girls and boys tended to increase as maternal education increased (Bhuiya & Streatfield 1991).

Famine and socio-economic status

The prolonged effect of the 1974-5 famine on infant and child mortality was examined by comparing the mortality rates of three cohorts of children who were born during and after famine by Razzaque, *et al.* (1990).

Using the cohort born after the famine as the reference group, the findings indicated that mortality was greater in the cohort born during the famine up to the second year of life, while for those born after the famine (or conceived during the famine) it was greater only in the first year. Further, post-neonatal mortality among the poor in the cohort born during the famine was greater than among the better off.

The mortality rate among children of very young mothers (less than 20 years old) born or conceived during the famine was unusually high in their second year.

2. CORRELATES OF CHILD HEALTH AND NUTRITION

There were only a few studies conducted on the proximate determinants of child survival these being morbidity, health care, nutritional status and food intake. Of these only a few attempted to relate socio-economic factors with the proximate determinants explaining the mechanisms in the relationship between socio-economic variables and child survival.

2.1. One such study was conducted in Matlab during the late seventies which examined the behavioural antecedents to the higher female than male mortality from shortly after birth through the child-bearing years. The study was based on a conceptual

framework that postulated the existence of a set of intermediate variables through which sex-biased attitudes and practices might operate to affect health, nutrition and mortality.

The malnutrition rate was found to be substantially higher among female children than among male children. In-depth dietary surveys showed that males consistently consumed more calories and proteins than females at all ages, even when nutrient requirements due to varying body weight, pregnancy, lactation and activity levels were considered.

Although child infection rates were similar between sexes, use of health care services at a free treatment unit showed a preference towards males. (Chen, *et al.*, 1981).

2.2. Subsequently, a study was conducted in 1981 in five villages during which information was collected about household socio-economic conditions, morbidity during the week preceding the survey, and anthropometry (namely weight, height and mid-upper-arm circumference).

The study included an analysis of how childhood morbidity and nutritional status related to household socio-economic indicators and the education level of household members including that of mothers. This was an attempt to elucidate some of the mechanisms in the relationship between socio-economic factors and childhood mortality (Bhuiya, 1983; Bhuiya, *et al.*, 1986a).

Household wealth indicators, such as size of landholding; possession of cows, boats and modern goods; occupation of household head; amount of tax paid in the previous year and size and quality of housing, were negatively associated with the proportion of children who could be classified as malnourished using standard criteria (Figure 3, overleaf).

The proportion of malnourished children had a similar relationship to the number of years of education obtained by the head of household, the child's mother and of the most educated household member.

Neither of the two measures of household sanitation, the source of drinking water and the use of a latrine, were correlated with nutritional status. No simple association was observed between any socio-economic or educational indicator and reported child morbidity in the week before the anthropometric measurement.

One particularly interesting finding was that the decline in the proportion of malnourished children seen with increasing socio-economic status was greater for males than females, so that girls were relatively more disadvantaged in households of higher socio-economic status.

Analysis of data from the above study was also done separately for boys and girls, by using multivariate analysis, to see whether the relationship between socio-economic factors and child nutritional status was different for boys and girls.

It was revealed that in this relationship there was in fact a gender difference: whereas for boys an increase in socio-economic status implied better nutritional status, for girls, the improvement in nutritional status was either trivial or not as great as it was for boys (Bhuiya, *et al.*, 1986b).

2.3. A similar study was carried out in 1986, using additional information about major childhood diseases and behaviour during sickness. A total of 1,128 children were visited once a month over three months to collect information on morbidity, sickness control and nutritional status. The study results, in terms of nutritional status and morbidity and their relationship to socio-economic variables, conformed with the findings of the previous study (Bhuiya, 1989).

Morbidity and inappropriate child-feeding practices were very common among children and thought to be important factors

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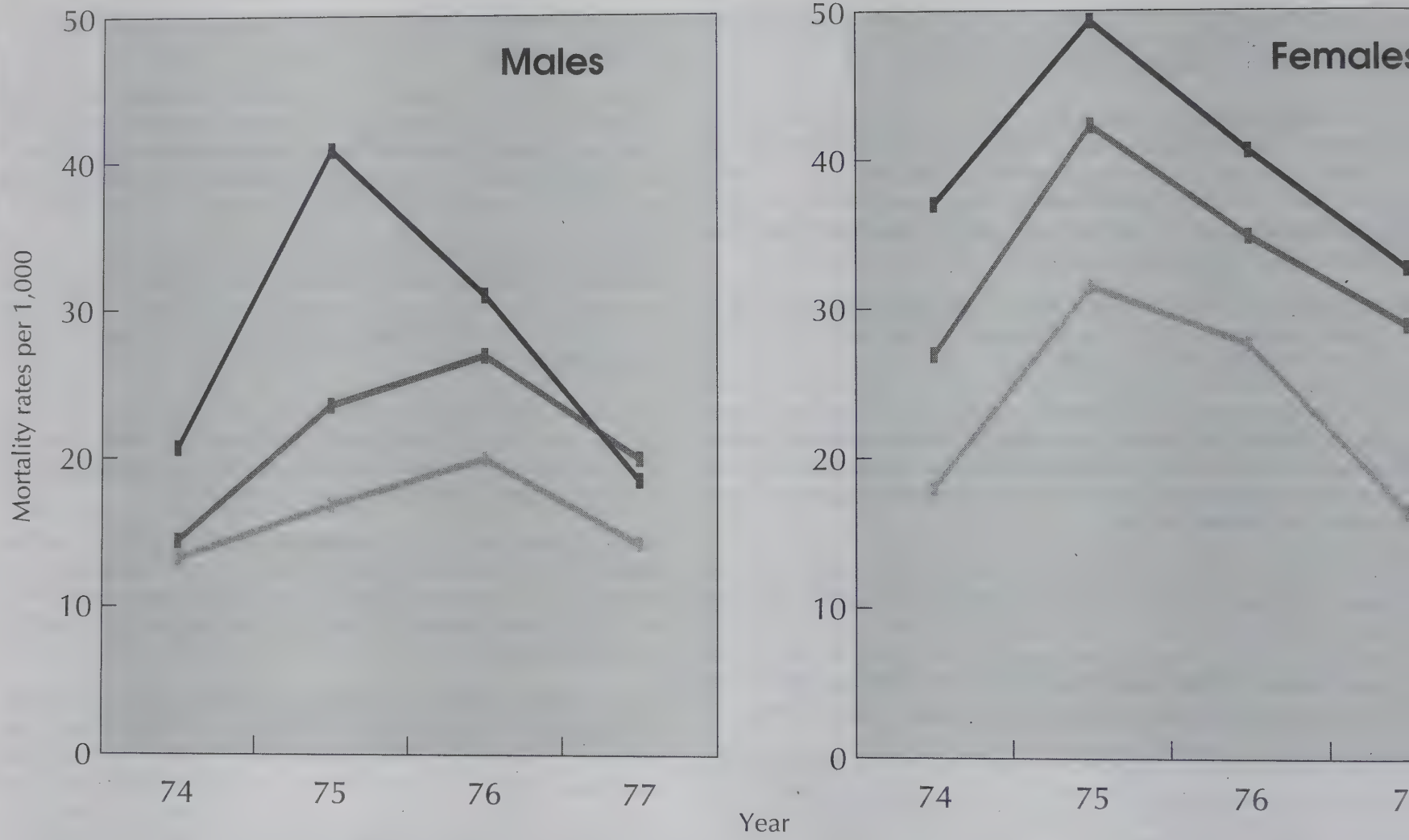


Fig 3: Mortality rates (1974-77) of children aged 1-4 years by number of cows owned by the household

Source: D'Souza et al. 1988

CONTINUED...
Socio-economic and Demographic Correlates

responsible for widespread malnutrition. Unhygienic practices and lack of appropriate knowledge about diseases were highly prevalent among mothers and were considered to be responsible for the high incidence of diseases, like diarrhoea, among children.

Traditional beliefs about the causes and transmission of disease were widespread in the community, and were regarded as important factors deterring parents from approaching modern methods of treatment and prevention. The practice of withholding food during sickness was found to exist probably aggravating the already poor nutritional situation of the study children. The above behavioural factors were also found to be somewhat dependent on household socio-economic conditions and the level of the mother's education (Bhuiya, *et al.*, 1989).

3. CONCLUSION: Problems and Prospects for Child Survival

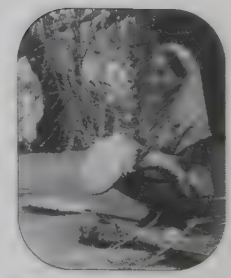
The above results lead one to conclude that the socio-economic differentials in childhood mortality in this community are parallel to the socio-economic differentials in nutritional status. This implies that mortality differentials, as observed for socio-economic variables among children in the study area, are largely due to differentials in malnutrition or growth faltering.

This is consistent with the findings of an intensive longitudinal study of patterns of growth among a sample of 197 children in Matlab which revealed that at 6 months of age, or prior to weaning, growth was equally stunted for boys and girls. Thereafter, sex differences in growth rates became prominent with the growth rate for females lagging far behind that of males (Brown, *et al.*, 1982), thus corroborating the link between higher mortality for females and nutritional status.

These studies support the argument that the death of children in this community is often a cumulative result of repeated biological insults resulting in growth faltering.

Thus to improve child survival an improvement in child nutritional status may be imperative which in effect will require a reduction in incidence and prevalence of disease.

Better survival of children in the well-off households indicated that some success has been achieved in some particular strata of the community which can eventually be transferred to the disadvantaged group. However, cultural bias against female children remains deep-rooted, and low socio-economic status is difficult to improve.



The five village studies have shown that simple anthropometric measures, like weight for height, can detect a large proportion of children at a high risk of mortality. Such measures as nutrition supplements for target groups showing severe malnutrition can be envisaged.

Death in the study area is almost always preceded by an incidence of sickness; sometimes the route from sickness to death is via growth faltering and sometimes it leads directly to death, depending on the nature of sickness.

Thus prevention of the incidence of disease would mean a better prospect for survival, but not all types of diseases can simply be prevented. Therefore, an improvement in curative measures is also highly desirable to increase survival.

A more general approach would be to reduce mortality by focusing on improvements in the proximate determinants. Immunizable diseases, like tetanus and measles, can easily be prevented through timely immunization, however the prospect of immunization is dependent on both its supply and demand. In the context of basic immunization, favourable social attitudes towards acceptance are clearly visible in the study area perhaps because of the activities of ICDDR,B and other government and non-government agencies.

Most of the mothers are aware of the existence of immunization possibilities; in half of the ICCDR,B field area of Matlab, immunization programmes are already in operation with great success in terms of acceptability. Thus, with the availability of

CONTINUED...
Socio-economic and Demographic Correlates

immunization accompanied by favourable social attitudes in the study area, a greater potential for a reduction in childhood mortality can be expected in the near future .

The reduction in the incidence of non-immunizable diseases, especially diarrhoea, is ideally the other desirable goal. However, their prevention is mostly dependent on improvements in the environment and in personal hygiene, both of which are extremely difficult areas for intervention. Isolated measures, such as provision of tube-well water, without a full awareness about hygiene and improved knowledge about the causes and transmission of diseases, like diarrhoea, seem to have had little effect.

In the absence of such knowledge and awareness, tube-well handles may be contaminated by the unaware users and, instead of protecting the users from diarrhoeal diseases, they become, rather, a way of spreading germs, increasing the risk of diarrhoeal incidence among the tube-well water drinkers. Similarly, in the case of heating food before serving, just warming can help the bacteria grow rather than kill them, also increasing the risk of diarrhoeal infections. A rise in the use of soap for washing hands will be beneficial too, although this increased awareness needs to be accompanied by greater purchasing power to ensure the availability of soap at the household level.

CONTINUED...
Socio-economic and Demographic Correlates

Given the degree of education, the economic conditions and the nature of the settlements, a rapid improvement in personal hygiene and the environment is unlikely to be seen in the near future. Thus, in the Matlab area, a significant reduction in the incidence of diarrhoeal diseases among children can hardly be expected soon.

Anthropological studies on the process by which maternal education reduces mortality show that education induces a cluster of attitudes and types of behaviour rather than a change in beliefs about the causes of disease (Lindenbaum, *et al.*, 1985).

Thus, in the current situation, the prospect of improving child survival, as regards non-immunizable diseases, such as diarrhoea, lies in the availability of better facilities for curative treatment.

The presence of ICDDR,B diarrhoeal treatment centres in that locality has already contributed to a reduction in diarrhoeal fatalities, although the success of such a clinic-based approach is limited for many reasons. One of the important factors is timely use of these facilities by the parents. Communication is extremely arduous although there are two to three ICDDR,B ambulance stations from where severe cases of diarrhoea are brought to the hospital by motorised boats. But even bringing a patient to the ambulance station needs a lot of effort involving walking long distances or travelling by country boat. In most cases, the treatment of severe cases of diarrhoea requires the mother to stay overnight in the hospital.

It is a major decision for an illiterate mother of that culture, who perhaps has had little interaction with the outside world, to stay outside in a place like a hospital and interact with unknown literate people. All these difficulties, as well as the economic ones *(even though the ambulance, treatment services and meals for the attendants are provided free of charge by ICDDR,B, the opportunity cost of the parents' labour is a factor)* contribute to delaying a visit to the hospital, making the health of the patient worse and reducing the prospects for survival.

Improvements in the transportation system in this locality are very slow, as they are in the rest of the country. The cultural restriction on the free movement of females in this Islam-dominated society is unlikely to change soon, and remains a factor inhibiting the success of such clinic-based treatment facilities.

The introduction of oral rehydration solution (ORS) for the treatment of diarrhoeal diseases, which can even be made at home, is definitely a promising step towards improving survival prospects among the children in the study area. The only problem still remaining is how to make the ORS popular among the mothers. Despite ICDDR,B's all-out efforts to popularise the

ORS in the community, its use is still far below the satisfactory level for a variety of reasons.

Unless the conception of the *causes* of diarrhoea and *the mechanism of dehydration* is convincingly clear to justify the use of ORS, its acceptability may be unsatisfactory. Even the motivated mothers mentioned that the standard ORS, in its present form, was distasteful and difficult for the children to drink.

An improvement in awareness about the scientific causes and consequences of diarrhoea and the relevance of ORS for treating diarrhoea as well as improving the present day ORS will be required to hasten its acceptability and effectiveness in the field.

Another important negative behavioural aspect associated with diarrhoea (and other sicknesses as well) is a change in feeding practices during an episode of illness. Mothers normally curtail the nutritional intake of the already underfed children during sickness, making the consequences worse.

This is also a culturally-rooted problem associated with the mothers' traditional beliefs about causes and treatment of disease and the value attached to food items. Mothers' ignorance about the nutritional requirements of the children and the traditional values attached to available food items results in restricted feeding of the children during normal times, which also has a negative effect on child health. This points to the need for health and nutrition education as well as improved household production or higher purchasing power to ensure that children are properly fed.

The importance of the curative aspect of disease can be complemented by the private health care providers (Claquin 1981). As observed, the allopath providers adopt western medicines to treat diseases, although their number in the locality is too small to play any significant role.

Nowadays, government training schemes, which are already in operation, have great hopes of building up a cadre of paramedics. However, the mere presence of the paramedics in the locality will not have the expected immediate impact unless the community members' beliefs about the causes and proper treatment of disease can be tuned to the line of scientific knowledge.

Moreover, unless the cost of service and treatment is kept within the reach of the rural people, they will not be able to get the full benefit of the paramedic services in the locality.

In conclusion, the studies referred to in this paper represent only a small fraction of all the scientific work done in Matlab using the DSS as the framework.

The DSS is a costly scientific instrument but the output more than justifies the expense. Some critical reflection of the use of the a specific field area is, however, necessary.

Are the various studies benefiting the local people? Are ethical norms being scrupulously maintained both in the design of vaccine trials and later in the administration of well-known inexpensive methods of reducing mortality in the comparison area?

The fact, as mentioned above, that cultural blocks, poverty or lack of education play important roles in hindering mortality decline, cannot allow the scientific researcher to remain unaffected by the developmental needs of the population in the area. New efforts are in fact being made with voluntary agencies, such as the Bangladesh Rural Advancement Committee (BRAC), to improve the socio-economic status of the local population.

ICDDR,B must maintain its pioneering role in combating diarrhoea world-wide, and thus improve child survival, but, as indicated in this section, success can only be achieved if *other* goals of a developmental nature are *simultaneously* arrived at. Such goals necessitate the commitment to develop applied research in a multidisciplinary approach

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Socio-economic and Demographic Correlates

Socio-economic and Demographic Correlates of Child Health and Mortality in Matlab

Abbas Bhuiya & Stan D'Souza

Lessons learned and recommendations:

Studies in Matlab revealed that children of illiterate mothers had a lower survival chance than those of literate ones. This differential existed even after controlling the effect of household economic conditions.

Due to cultural reasons, female children were disadvantaged in terms of survival after few months of life. This sex-biased mortality situation did not improve even for the children of literate mothers. Although the impact of free health care services in reducing the gender gap in mortality has not yet been fully explored, there was some crude indication that the availability of free health services on the door-step might be of some benefit in reducing this gap.

The children of very young and high parity mothers were also found to risk high mortality. Perhaps one of the ways to tackle this problem would be to avoid high-risk births.

Future research should be directed towards identifying the crucial behavioural determinants of child health and survival on the one hand and the identification of factors that influence that behaviour on the other. Results of this research will help programme designers develop the most appropriate and effective health intervention programmes.

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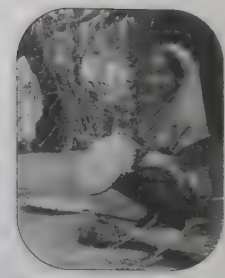

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Community life within a bari offers plenty of opportunity for socialising, playing and learning from each other. But how will they share their future?

Life expectancy has increased in Matlab in the last ten years. but has the quality of life improved?

CHAPTER 20

A Cost-effectiveness Analysis of the Matlab Family Planning-Health Services 1978-85

Deborah Balk
George B. Simmons
Khodezatul K. Faiz

In 1977, only about 8 in 100 married women (of reproductive age) in the Matlab Family Planning-Health Services Project (FPHSP) area and in the neighbouring comparison area were using contraception. In 1978, at the onset of the FPHSP, the contraceptive-use prevalence rate (CPR) in the Project's treatment area rose to 24 per cent, while the comparison area remained near its old rate at 7 per cent.

By 1985, about 44 per cent of the treatment area eligible couples were using contraception. In the comparison area, the CPR had not risen much since 1978: Nearly 12 per cent of couples were using contraception.

By 1990, the CPR in the treatment area had risen to 57 per cent (Koenig, *et al.*, 1992), a rate commonly found in contemporary low-fertility regions. By this time, although the CPR had risen markedly in the comparison area to 27 per cent, it was still less than half the rate of contraceptive use in the treatment area.

There have been parallel increases in the use of health care in the treatment area over this period which has, on average, led to significant differences in infant, child and maternal mortality rates between the treatment and comparison areas.

Many chapters in this volume have addressed the medical and social impact of this tremendous increase in the adoption and use of contraception and health care. What this chapter seeks to do is to examine the costs required to bring about these demographic changes.

**The text of this chapter is a modified version, reproduced with the permission of The Population Council, of an article published in Studies in Family Planning (March/April 1991; 22(2): 83-101) under the title "Cost-effectiveness analysis of family planning programmes in rural Bangladesh: Evidence from Matlab", by George B. Simmons, Deborah Balk, and Khodezatul K. Faiz. This chapter was prepared after the death of Dr. George Simmons. While his contribution to this study was integral, we accept sole responsibility for errors or omissions in this paper. The authors thank the staff of the MCH-FP Extension Project and of the Matlab field station.*

In this analysis, we assess the cost-effectiveness of the family planning and MCH programme in Matlab from the onset of the FPHSP in 1978 through to 1985. (Also see Simmons, *et al.*, 1991; Balk, *et al.*, 1988). An analysis looking at an expanded set of services provided since 1986 is found in the following chapter in this book (Chapter 21).

To understand the cost-effectiveness of the FPHSP one must compare the *intervention area* to an *area without intervention* (or any area of Bangladesh which only receives government health and family planning services). The manner in which the government and the FPHSP achieve the goal of lower fertility and mortality differs.

The basic hypothesis of the FPHSP is that an increase in the availability of high-quality family planning and MCH services delivered to the households of a typical rural area in Bangladesh will lead to considerable increases in the acceptance of preventive health and family planning services.

This goal is achieved by providing more resources at the field level than in the government programme and introducing a management system to assure that these resources are well used.

Thus, key elements in the experiment include regular household visits, adequate supplies of a range of contraceptives, vaccines and other medicines, and an effective management system.

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Cost-effectiveness of the Matlab FP-HS

As a secondary component of the project, the regularity of household visits and the availability of high-quality services is expected to have a modest demand-increasing effect (Phillips, *et al.*, 1984a).

A comparison of the types of maternal and child health care services provided by the FPHSP and the government is shown in Table 1 (right) for the period from 1978 to 1985.

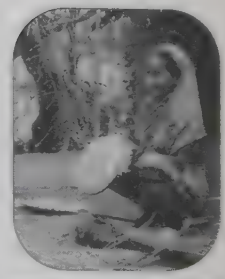
TABLE 1

Comparison of the services and structure of the FPHSP and the Government of Bangladesh (GOB) National Family Planning Programme, from 1978-85

Item	FPHSP	GOB
Family planning methods	Orals Tubectomy Vasectomy Condoms Foam IUDS Injectables	Orals Tubectomy Condoms
Vaccinations[a]	Tetanus Measles	
General medicines	ORS[b] Others (moderate availability)	ORS[b] Others (limited availability)
Worker: client ratio	1:1,200	1:7,500
Service orientation	"Cafeteria" approach integrated programme	Compartmentalised
Organisational structure	Horizontal	Vertical

[a] GOB officially starts an Expanded Programme on immunisation (EPI) in 1983, but implementation does not begin until 1986. In the FPHSP, all vaccines were not available in all areas until 1986. At this time, diphtheria, BCG, and polio vaccines were added, making the FPHSP vaccination package identical to the EPI.

[b] Oral rehydration salts.



Since 1986, the provision of services has changed considerably in both areas, mostly by adding health services; these changes are not addressed here.

While the approach of the FPHSP has always been an integrated, "cafeteria" style programme, the thrust of service provision in the early years was family planning.

A summary of contraceptive prevalence in the Matlab treatment and comparison areas, as well as for the nation, is shown in Table 2 (below). The main goal of this chapter is to accurately assess the cost-effectiveness associated with these different contraceptive-use patterns and, implicitly, demographic patterns.

1. MODELS, METHODS, AND DATA

The FPHSP was designed as a trial with a treatment and a comparison area that theoretically differ only by the presence of the FPHSP, which implies one needs to measure only the additional cost and effect of the FPHSP in the treatment area to generate a cost-effectiveness ratio.

TABLE 2

Summary of contraceptive prevalence rates in the FPHSP treatment and comparison areas, and in the nation: 1975-85

	FPHSP		
Year	**Treatment**	**Comparison**	**National**
1975	3.0	3.0	**4.5**
1976	9.5	9.5	5.3
1977	9.0	**7.9**	6.3
1978	24.2	7.0	7.5
1979	30.9	**7.7**	**8.9**
1980	30.0	**8.2**	9.8
1981	31.8	**8.9**	**10.9**
1982	33.6	**9.6**	12.3
1983	37.3	**10.4**	**13.8**
1984	41.7	11.0	17.7
1985	44.1	**11.6**	**22.8**

Note: Use rates are for modern methods only. Figures in boldface have been interpolated from empirical data.
Sources: Monthly Contraceptive Use Rate Chart of Matlab FPHSP, ICDDR,B; M. Rahman *et al.*, "Contraceptive distribution in Bangladesh: Some lessons learned," *Studies in Family Planning* 11, 6 (1980): 191-210; in-depth survey, MCH-FP Extension Project ICDDR,B (1984); BFS and NIPORT as reported in Mitra and Kamal, 1985.

CONTINUED...
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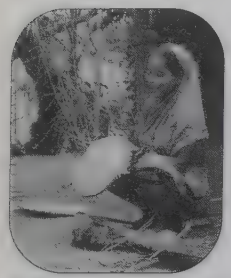

TABLE 3

The theoretical and actual models of the FPHSP

	Theoretical model		Actual model	
Variable	**Treatment area**	**Comparison area**	**Treatment area**	**Comparison area**
Government effort	Normal	Normal	Little or none	Between less than normal and none
Demographic and economic conditions	Poor region with high fertility and mortality at project start	Poor region with high fertility and mortality	Poor region with marginally lower fertility[a] and high mortality	Poor region with high fertility and mortality
Services from project	Full range of intervention	None	Wide range of contraceptive and MCH intervention	ORS and some clinical services

[a] Implies that fertility is marginally lower in the treatment area than in the comparison area, but not lower than the national average, at the start of the project.

TABLE 4

Models used to generate cost-effectiveness ratios for the FPHSP in Matlab

Model	Description	Yield
Model I: Experimental design	Assumes that the same services are provided by the government program in both the comparison and treatment areas and that the socioeconomic and demographic conditions are the same in the two areas (theoretical model in Table 3)	One cost-effectiveness ratio (independent comparison required)
Model II: Quasi-experimental design	Adjustments to the experimental model are made for varying levels of governmental activities in both treatment and comparison areas (e.g. payment of compensation fees) and for the FPHSP effort in the control area (e.g., providing sterilisation services to comparison area residents) (actual model in Table 3)	One cost-effectiveness ratio (independent comparison required)
Model III: Nonexperimental design	The full costs and impact are estimated independently for each area and analytical techniques are required to estimate output and impact (actual model in Table 3)	Two cost-effectiveness ratios (comparable)

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Cost-effectiveness of the Matlab FP-HS

Unfortunately, two key problems that arise with this design are:

1) the actual model of the trial probably differs from the theoretical model, as shown in Table 3 (facing page) ; and
2) as the experimental design model yields only one cost-effectiveness ratio (highlighted in Table 4, facing page), an independent comparison (not from this study) is required.

As a point of departure, we will consider the experimental design model, Model I. Table 4 lists the types of adjustments that need to be made for flaws inherent to the situation. These will be discussed in detail after the presentation of the methods and results of Model I. To improve upon the experiment, we will calculate a cost-effectiveness ratio for the quasi-experimental model, Model II.

To substantiate the estimates from Models I and II with a comparison ratio, we will use a non-experimental model, Model III, to generate a third measure of cost-effectiveness of the FPHSP.

In this chapter, we are concerned only with the costs related to the provision of core services. Evidence suggests that the supervision and management systems of the FPHSP are integral to the effective and continuous provision of home-based and clinical services (see Phillips, *et al.*, 1984a).

For this reason, the cost of all physical and human capital, commodities, and services closely related to the activities of the frontline field workers are included here. The concern raised about inputs and activities, such as research and international technical assistance, which are often associated with a pilot project such as the FPHSP, is addressed elsewhere (see Balk, *et al.*, 1988; Simmons, *et al.*, 1991).

The data for this study have been collected from several sources, and they are of variable quality and completeness. The cost analysis requires data and information regarding service delivery and programme effects as well as their related cost.

Much of the data and information concerning the FPHSP are derived from published reports (for example, Demographic Surveillance System Reports of the ICDDR,B), while other data, especially those concerning the costs and all activities outside the treatment area, were collected specifically for this analysis.

Data were collected from four general sources: the ICDDR,B, the government, the donors, and the market (see Balk, *et al.*, 1988, for further detail). All rates and cost figures in this analysis represent calendar years (January-December).

2. MODEL I

2. 1. Costs

Here, we highlight only two of the numerous issues related to costs to examine programme costs with respect to effectiveness:

1) the total annual cost of the project from 1978 to 1985, and

2) the cost of the various project components.

Following Model I, we need only to measure the cost of the FPHSP. The total costs of the project can be seen in Table 5 (overleaf).

From 1978 to 1985, the annual cost of the core service ring ranges from $133,458 to $170,958 (in constant 1985 US Dollars).

In Table 5 (overleaf), costs are broken down by component and divided into variable and fixed costs. In the short run, variable costs might be expected to fluctuate with the number of contraceptive users or project clients. In the longer run, fixed costs would also change with the size and scope of the project.

In the short run, however, project staff, which account for nearly 50 per cent of overall costs, should be viewed as a fixed cost.

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TABLE 5

The total cost of the FPHSP, by project component and year, in constant (1985) US$

	US$, by year								% of total,
Costs	**1978**	**1979**	**1980**	**1981**	**1982**	**1983**	**1984**	**1985**	**1978-85**
Variable costs									
Contraceptives	12,042	15,366	14,934	12,719	11,192	11,374	12,129	12,675	(8.24)
Vaccines	0	8	67	173	624	180	277	211	(0.12)
Oral rehydration salts	241	4,919	11,140	10,342	5,799	7,302	7,497	6,068	(4.29)
General medicines	5,010	6,005	7,056	7,083	5,870	5,349	4,921	2,587	(3.53)
Service related supplies	5,928	7,227	5,087	4,727	5,734	5,133	5,133	5,133	(3.55)
Fixed costs									
Personnel	80,199	78,965	80,450	61,787	61,556	77,294	79,384	88,631	(48.95)
Transportation	21,515	19,191	17,925	16,134	14,905	15,306	15,863	15,015	(10.93)
Building facilities	3,944	3,749	3,627	3,477	3,443	3,509	3,583	3,725	(2.34)
Equipment and furniture	1,195	1,344	1,554	1,552	1,467	1,531	1,666	1,727	(0.97)
Nonservice related supplies	625	625	625	625	625	625	625	625	(0.40)
Subtotal	130,699	137,400	142,465	118,619	111,215	127,603	131,078	136,397	(83.33)
Overhead	26,140	27,480	28,493	23,724	22,243	25,521	26,216	27,279	(16.67)
Total cost (US$)	159,839	164,880	170,958	142,343	133,458	153,124	157,294	163,676	(100.00)

CONTINUED...

Cost-effectiveness of the Matlab FP-HS

The basic staffing pattern has not changed since the onset of the project, although the activities and load of the staff have changed over the past 10 years.

However, due to a reduction in the staff doctor's contribution to the basic service provision in 1981 and 1982, the cost of personnel and thus the overall cost for these years is marginally lower than average.

The variation in the relative expenditures on vaccines and oral rehydration salts (ORS) follows programmatic changes in these interventions.

Of the total cost, personnel accounts for nearly half; transportation for about 10 per cent, and contraceptives for about 8 per cent. The cost of vaccines, furniture, and equipment for the project's five clinics each account for less than 1 per cent of project costs.

2. 2. Effects

Assuming that the control and treatment areas were chosen in a perfectly random manner, that the government programme continued to be the same in each area over the life of the project, and that no spillovers occurred from the treatment to the comparison area, as we do in Model I, the estimate of the project effects is straightforward.

The net impact of the experiment is the difference in the demographic rates (that is, fertility or mortality) in the treatment and comparison areas multiplied by the number of people at risk in the treatment area. Here, this approach is applied to contraceptive use, fertility, and mortality, although the approach is illustrated below for fertility.

Table 6 (below) presents estimates of the number of births prevented by the project using the general fertility rate (GFR) of the comparison area as a base.

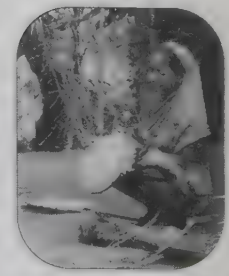

TABLE 6

Estimated number of additional births prevented (BP) by the FPHSP by year, 1978-85

	General fertility rate			
(1)	(2)	(3)	(4)	(5)
Year	**Treatment area**	**Comparison area**	**Number of women in the FPHSP areas (age 15-49)**	**Number of BP by the FPHSP**
1978	138	164	20,714	538
1979	150	205	20,917	1,150
1980	156	195	21,667	845
1981	148	189	22,041	903
1982	156	192	22,436	808
1983	144	185	22,929	940
1984	128	160	22,384	748
1985[a]	143	185	22,370	982
Total births prevented	—	—	—	6,914

Note: Births prevented is calculated as follows: [column (3) - column (2)] x column (4)/1,000.
[a] Provisional.

Source: Demographic Surveillance System, ICDDR,B.

CONTINUED...
Cost-effectiveness of the Matlab FP-HS

According to Model I, from 1978 to 1985, a cumulative 6,914 births were prevented by the FPHSP activities in the treatment area.

After adjusting for the deaths that would have occurred among the 6,914 births prevented, this represents a reduction of about 6 per cent from the 1985 population of the treatment area. The estimated mid-year population in the FPHSP treatment area in 1985 was 97,762. These annual infant and child death rates in the treatment area were used to make the downward adjustments.

This same technique is used to calculate the number of contraceptive users generated by the FPHSP. The calculation follows the same logic as that shown in Table 6 except that the treatment and comparison area contraceptive-prevalence rates from Table 2 are substituted for the general fertility rate, and the number of eligible couples are substituted for the number of women aged 15 to 49 years.

From 1978 to 1985, a total of 29,674 contraceptive users were generated by the presence of the project. Using the same technique with the infant and child mortality rates and the

TABLE 7

Measures of cost-effectiveness of the FPHSP given the experimental design, Model I, by year, in constant (1985) US$

		Cost-Effectiveness Ratio		Measures of cost and effectiveness			Cost per
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Year	Core service cost	Contraceptive users generated (CU)	Births prevented (BP)	Infant deaths prevented (IDP)	Child deaths prevented (CDP)	Contraceptive users generated (2):(3)	Births prevented (2):(4)
1978	156,839	2,413	538	36	5	65	292
1979	164,880	3,353	1,150	9	100	49	143
1980	170,958	3,367	845	66	74	51	202
1981	142,343	3,397	903	35	66	42	158
1982	133,458	3,593	808	38	95	37	165
1983	153,124	4,043	940	46	150	38	163
1984	157,294	4,623	748	38	181	34	210
1985	163,675	4,885	982	92	75	34	167
Total	1,242,571	29,674	6,914	360	736		
Average Cost	42	180					

CONTINUED...

Cost-effectiveness of the Matlab FP-HS

appropriate population at risk, it was calculated that 360 infant deaths and 736 child deaths were prevented by the FPHSP from 1978 to 1985.

No attempt is made here to aggregate the effects of the FPHSP. Given that the population at risk is changing in the treatment area, a reduction in fertility implies a smaller population of infants and children at risk of dying than would be the case in the absence of a fertility decline. As such, it is unclear how to construct or interpret an aggregated measure of births and deaths prevented.

The number of deaths averted by project activities, however, indicates that any estimate of project costs which does not make comparisons to the full range of effects will be over-estimated.

2. 3. A Cost-Effectiveness Ratio

The cost-effectiveness analysis presented here is built upon the results of Model I, the FPHSP experiment. Summary cost and effect information is shown in Table 7 (facing page). The range of effects is more dramatic than the variation in costs. The number of annual additional contraceptive users generated by the project is close to 2,500 in the first year of the intervention and nearly double eight years later.

From 1978 to 1985, 6,914 births, 360 infant deaths, and 736 child deaths were averted by the project.

The cost per unit of effect differs according to the measure used. To some extent this is just a matter of scale, but to the degree that differences exist among the factors that relate contraceptive use to demographic impact, these different outcome measures may provide fundamentally different estimates of cost-effectiveness.

No obvious correlation exists between the cost-effectiveness of contraceptive use and births prevented. Differences between the ratios might be due to:

1) the time lag between use and demographic change, and

2) the fact that contraceptive users do not indicate for what period each user uses or a user's pattern of compliance. These may lead to lower than expected changes in demographic behaviour.

Two questions arise regarding the average cost findings of $42 per contraceptive user and $180 per birth prevented:

1) Are these estimates high or low? and

2) Do these estimates describe accurately the situation in Matlab?

The former question raises the issue of what is an appropriate comparison, either within Bangladesh or cross-nationally. The answer to the latter question depends on the validity of the assumptions on which the experimental model rests.

2.4. Issues in Comparisons within the Experimental Framework

Cost-effectiveness analysis serves a useful comparative purpose. In this analysis, however, there are major difficulties in defining an appropriate basis for comparison.

The above experimental framework, Model I, and the quasi-experimental framework, Model II (page 384), each generate only one estimate of cost-effectiveness. Thus, no basis for comparison is inherent in the framework. The definition of an appropriate comparison is itself particularly difficult.

Ideally, we want to compare the costs per unit of the effect of moving from a contraceptive prevalence rate of about 10 per cent to one of about 47 per cent. It is important to recognize that in attempting to influence the type, quality, and quantity of both contraceptive and MCH services, the FPHSP aims for a rather complex set of effects.

Ideally, then, it should be matched against a project or programme with a similarly broad set of goals. There are a few independent

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estimates of cost-effectiveness available for other family planning programmes, but since they were generated in other situations using different methods, the comparisons may be awkward. Before making such comparisons, however, we consider the strength of the estimates produced by the experiment.

2. 5. Threats to the Validity of the Experiment

Complex field experiments are beset with potential threats to the validity of the experimental design. The major possibilities in this case, as illustrated in Table 3, are:

(1) differences in the initial conditions of the treatment and comparison areas,

(2) evolutional differences in government involvement in the two-areas, and

(3) potential experimental effects outside the treatment area.

First, given the areal and community nature of the project, it was not appropriate to randomize treatments at the level of the individual. On the one hand, the fact that there were no significant differences in socio-economic and demographic characteristics between the two areas (see Chowdhury & Phillips, 1985) justifies the adoption of the experimental model; on the other hand, there were small initial differences in the fertility rates of the two populations (see Phillips, *et al.*, 1988).

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Cost-effectiveness of the Matlab FP-HS

Second, the level of government involvement in the treatment and comparison area is unclear. It is plausible that the project services in the treatment area may have induced a reaction on the part of government staff that violates the model assumptions of equal government involvement in the two areas.

In theory, only the services offered by the ICDDR,B distinguish these two areas, because, in principle, the government provides the same range and quantity of family planning and other health services throughout Bangladesh, with variations resulting only from differences in demand or from the capabilities of individual providers.In practice, of course, there are many deviations from this ideal. To complicate matters, not all of the differences are documented regularly by research activities of the FPHSP.

Since excessive data collection in the comparison area might lead to changes in the health and family planning behaviour of the local residents, research activities have been held to a minimum.

Moreover, since the government activities are not an explicit focus of the research design for either area, they have not been well documented over the life of the project. For these reasons, our documentation of the provision of government services in Matlab subdistrict is incomplete.

Koenig and colleagues (1992) conclude that, in the treatment area, **the government has largely yielded responsibility for outreach service delivery to ICDDR,B** and itself plays a nominal role and that the observed differences between the treatment and comparison areas in outreach services are almost wholly a reflection of differences between the ICDDR,B and government service programmes.

In a 1990 survey of contraceptive knowledge, attitudes, and practices (KAP) (see Chapter 15) in the treatment and comparison areas, they find that during the three-month period preceding the survey about 15 per cent of women in the treatment-area reported receiving a visit by a government field worker (family welfare assistant, FWA) and about 40 per cent of the women in the comparison area reported receiving at least one visit by an FWA; *98 per cent of treatment-area women reported one or more visits during the same period by an ICDDR,B field worker (community health worker, CHW).*

Of the total visits made to treatment-area women, only four per cent were made by government workers. Of these women visited by FWAs, less than 1 per cent in the treatment area and about 5

per cent in the comparison area received contraceptives (or a referral for a tubectomy) in that visit.

Although this KAP survey is describing a situation about five years after the one we are describing, it is reasonable to assume these patterns place an upward bound on government activities during the years of our study (upward because the government effort may have increased in recent years as a result of increases in FWA recruitment).

Further evidence of the inefficiency of the government's programme in the Matlab region is provided in an ESCAP report (Mabud & Waliullah, 1986).

Because this and other anecdotal evidence suggests that the government is providing fewer services than the national average in both areas (and even in the entire subdistrict), we believe that national-level performance data overstate the situation in Matlab. Although the government level of service is not average, it also is not atypical for many areas in Bangladesh.

Third, the FPHSP also generates effects outside the treatment area. For example, FPHSP clinical services (i.e. tubectomies and IUD insertions) are available to women from the control and non-study areas, and ORS is regularly distributed by the FPHSP surveillance staff in the comparison area. Fortunately, service statistics, by client's place of residence, are maintained by the project.

It is also possible that the mere presence of female surveillance workers affects the attitudes and demographic behaviour of comparison area residents (Koenig, *et al.*, 1987). Evidence on this point, however, has not been well documented over the study period.

To summarize, we believe that the pure experimental design of the FPHSP, Model I, is compromised by variable government activities within the treatment and comparison areas and by project activities outside the treatment area. The ways in which the experimental design may mis-state either project costs or effects are outlined in Table 8 (right).

TABLE 8

Ways in which the experimental design of the FPHSP may mis-state either the costs or effects of the project.

Misstatement	Reason
Overstates effects and/or understates costs	* Treatment area fertility was marginally lower than control area fertility from the beginning. * The ICDDR,B inputs into Matlab may be understated by the project's budget. * The government spends money on client compensation fees in the treatment area that is not reflected in the FPHSP budget.
Understates effects and/or overstates costs	* FPHSP activities, especially sterilisation and IUD insertions done at the central clinic, influence fertility in the comparison and nonstudy areas. * The treatment area does not receive efforts of the government programme while the comparison area does. * The outreach activities of the FPHSP in the treatment area may have influenced the demand for contraception in the comparison area. * An unadjusted measure of births prevented does not include present or future effects of the project (i.e., the full cumulative effect of the actions in earlier periods is not recorded). * Morbidity effects, improvements in the quality of life for women, and other effects are not calculated. * The relationship between fertility change and mortality change is not taken into account—e.g., the number of children at risk of dying.

CONTINUED...

Cost-effectiveness of the Matlab FP-HS

3. A SENSITIVITY ANALYSIS: MODELS II AND III

Tables 4 and 8 present weaknesses with the cost-effectiveness ratio produced by the experimental design. In this section, we consider alternative models exploring independent estimates of cost and impact.

These are used to modify the experiment (Model II) and to generate additional estimates of cost-effectiveness for the treatment and comparison areas (Model III). With these additional data, we believe that our results accurately describe the FPHSP. The analytical techniques used to transform Model I into Model II are also used to generate the cost-effectiveness ratios of the non-experimental approach in Model III.

The conceptual and data requirements of these techniques violate the pure experimental design; that is, they examine the role of the FPHSP beyond the borders of the experiment.

In both Models II and III, the calculation of costs is relatively straightforward. These models take into account the cost of providing FPHSP services in both the treatment and comparison

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TABLE 9

Assumptions used for calculating demographic impact of estimated contraceptive use

				Adjustments to BP	
(1)	(2)	(3)	(4)	(5)	(6)
Method, j	UCYP per user	CYP per BP	Lag between use and effect in years, i	Discount rate, r	Adjustment factor, a
Nonclinical					
Injectable	1	3.5	1	.15	.87
Orals	1	3.5	1	.15	.87
Condom	1	3.5	1	.15	.87
Foam	1	3.5	1	.15	.87
Clinical					
IUD	2.5	3.5	2	.15	.756
Tubectomy	7.75	3.5	4	.15	.572
Vasectomy	7.75	3.5	4	.15	.572

Note: $a_j = \frac{1}{(1+r)^i}$

UCYP = Unstandardized Couple Years of Population; **CYP**= Couple Years of Protection; **BP**= Birth Prevented

areas as well as the cost of various government services in the treatment and comparison areas.

Neither Model II nor III, however, alleviates the complexity of measuring the effects of a multifaceted project like the FPHSP.

While the influence of the project on contraceptive use and fertility outside the treatment area seems well-defined and measurable, its effect on mortality is less clear despite several interventions aimed at mortality reduction.

Therefore, in these models, the analysis of effects is restricted only to contraceptive use and fertility behaviour.In each model, we begin by considering method-specific contraceptive-use rates. They are then translated into other output measures with the adjustments found in Table 9 (facing page).

First, contraceptive-use statistics are converted into unstandardized couple years of protection (UCYP) using conventional methods (Wishik and Chen, 1973; Yinger, *et al.*, 1983), where the annual number of users (or acceptors for clinical methods) is multiplied by an estimated amount of method-specific protection afforded in column two (for example, an IUD acceptor in a given year will have, on average, 2.5 years of protection). To reduce the excess emphasis given to older, less fecund users, we weight the users by age (Rider & Tayback, 1983) and produce an estimate of standardized couple-years of protection (SCYP).

Second, (standardized, in our case) CYP are converted into the number of births prevented (BP). This number was chosen to reflect the age-specific fertility of women in the principal ages of contraceptive use. Finally, the estimate of BP needs to be further refined to reflect two types of lags. First, a method-specific adjustment reflecting the interval between the time of contraceptive use/acceptance and the time fertility takes place is required. For temporary methods, the minimal interval is nine months, and for longer-term and permanent methods, it may be as long as four years. Second, the present value of the investment needs to be taken into account.

From the point of view of planners, events that are delayed are less important than those that are close to the time of decision. Each year of additional impact is "discounted" by 15 per cent, for all methods.

These refinements result in an adjustment factor, which reduces the relative impact of sterilization and increases that of temporary methods (column six, Table 9, facing page). The results of these adjustments are discussed in the following two sections.

3. 1. Model II: The Quasi-Experimental Design

The next three subsections present data on the costs, effects, and cost-effectiveness of Model II. Here, we make one adjustment to the cost-effectiveness ratio of Model I.

First, we adjust the cost estimates to recognize the government's expenditure on compensation fees to clinical clients served by the FPHSP to more accurately represent the (known) government costs in the treatment area.

Second, we adjust the effects for the FPHSP's provision of clinical services (and ORS distribution) to residents of the comparison and non-study areas. Elsewhere we have elaborated on other combinations of these inputs and impacts adjustments (Simmons, *et al.*, 1991).

While we do not know the extent of the FPHSP's effects outside the treatment area and cannot measure some of the effects in the treatment area, nor can we be certain about the level of expenditures other than what we observe, we feel this adjustment represents a correction in the right direction of the cost-effectiveness of the experiment.

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TABLE 10

Cumulative costs under Models I, II, and III for the treatment and comparison areas in constant (1985) US$

	Model I	Model II	Model III	
(1) Category of costs & models	(2) Treatment	(3) Treatment	(4) Treatment	(5) Comparison
I Bookkeeping costs (Core service costs: includes service delivery, supervision administration with overhead)	**1,242,571**			
II Adjusted cost				
+ Core service cost		1,242,571		
+ Compensation fees		25,448		
= Total		**1,268,019**		
III Costs reflecting GOB activities				
(a) Adjusted cost (above, Model II)			**1,268,019**	
(b) Cost of service provision in the comparison area:				
(i) Bookkeeping				**403,867**
(ii) Adjusted cost to reflect externally generated effects:	403,867			
- Cost of FPHSP clinical services[a]				(12,270)
- GOB compensation fees associated with FPHSP clinical services				(3,108)
= Total[b]				**388,489**

[a]Numbers in the table have been adjusted to reflect overhead.
[b]Derived from Balk *et al.*, 1988, Table IV-28.

CONTINUED...

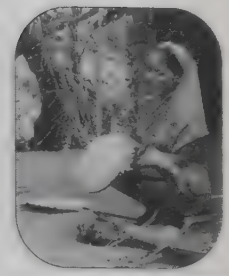
Cost-effectiveness of the Matlab FP-HS

3. 2. Model II: Costs

As shown in Table 10 (facing page), the adjustment yields a revised estimate of Model I's "bookkeeping" cost by adding the cost of the compensation fees yielding a cumulative cost estimate of $1,268,019, which is about 2 per cent more than the "bookkeeping" cost of Model I (Balk, *et al.*, 1988:82-88, for details).

3. 3. Model II: Effect

Instead of controlling for the costs incurred by the project in the delivery of services to residents outside the treatment area (which are not fully known), we can control for the additional effects generated by the FPHSP. We make adjustments specifically for sterilization and IUD services by attributing full credit for these activities to the FPHSP.



To calculate the Model II effects, we combine methods from the experimental design and the non-experimental approach. To the base numbers (see Table 7, columns three and four), we add a directly-calculated adjustment for the additional contraceptive

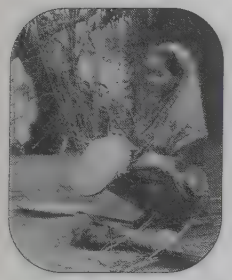
TABLE 11

Estimated number of UCYP, SCYP, and ABP generated by the FPHSP in the comparison area, from sterilisation services, 1978-85.

(1) Year	(2) Number of sterilisations for comparison area residents	(3) Unstandardised couple years protection (UCYP)[a]	4) Standardised couple-years protection (SCYP)[b]	(5) Adjusted births prevented (ABP)[c]
1978	0	0	0	0
1979	0	0	0	0
1980	53	411	290	47
1981	34	264	193	32
1982	61	473	358	59
1983	60	465	364	59
1984	51	395	320	52
1985	44	341	285	47
Total	**303**	**2,349**	**1,810**	**296**

[a]UCYP = Column 2 x (Table 9, Column 2).
[b]SCYP = Column 3 x age distribution weights, where users <35 = 1 and users ≥ 35 = .33 (see Balk *et al.*, 1988, Table III-10, for methodwise age distributions).
[c]ABP = [(Column 4 : (Table 7, Column 3)] x (Table 9, Column 6).

CONTINUED...
Cost-effectiveness of the Matlab FP-HS



use and fertility change generated by the FPHSP activities that have spilled over into the comparison and the non-study areas.

An example of the number of UCYP, SCYP, and ABP generated by the FPHSP for sterilizations provided to comparison area residents is shown in Table 11, (previous page).

The experimental result (Model I) includes only cumulating effects up through 1985 for the treatment area, whereas the adjustment (Model II) also accounts for the future impact of present contraceptive use of non-treatment area clients.

This suggests that the effects of Model II still do not take the full future impact of the FPHSP into account. Given this caveat, the cumulative number of births prevented estimated by the Model II adjustment is 8,029 (Balk, *et al.*, 1988; Table V-11).

In other words, of all the births averted by the project, approximately 14 per cent occur outside the treatment area.

3. 4. Model II: A Cost-Effectiveness Ratio

With these adjusted measures of cost and effect, we can generate an adjusted cost-effectiveness ratio. Recall our assumption that expenditures on populations from outside the treatment area do not have any demographic impact on treatment area residents, but they are likely to have an effect on the behaviour of the comparison or non-study area populations.

CONTINUED...
Cost-effectiveness of the Matlab FP-HS

In choosing to adjust for changes in effect rather than costs, we produce cost-effectiveness ratios that range from $25 to $68 per standardized couple-year of protection and from $144 to $307 per adjusted birth prevented, annually. On average, this amounts to $35 per SCYP and $158 per birth prevented.

The project costs used for this adjustment include the cost of government compensation fees, for both treatment and non-treatment area acceptors. Given our understanding of the possibilities for over-estimation of costs and the under-estimation of effects in the treatment and non-treatment areas, we tend to think that the quasi-experimental model may represent the best single measure of cost-effectiveness of the FPHSP within the general experimental framework.

At this point, we have made only minor adjustments to the basic model; other adjustments are considered in Model III. Before proceeding with Model III, let us consider the possibility of a comparison of the above ratios with other ratios.

One comparison comes from a recent assessment of the cost per birth prevented in the government programme of about $58 and $74 in 1982 and 1983, respectively (Simmons, *et al.*, 1986). Since these were peak sterilization years in the government programme, the recent cost per birth prevented has likely been higher. Moreover, these estimates included the delayed birth-reducing effects of methods, such as the IUD and sterilization.

A major issue in family planning programme cost-effectiveness is method mix among contraceptive users. Simmons, *et al.* (1986) estimated that, in 1983, the cost to the government of delivering contraceptive services was about $45 per adjusted birth prevented for sterilization and $125 for adjusted birth prevented for temporary methods.

For the sake of comparison, the cost per birth prevented (for all methods) according to Model I is $165 in 1982 and $163 in 1983 (see Table 7). In Model II, the cost per birth prevented is $122 in 1982 and $145 in 1983.

These ratios are on a par with the government's ratio for temporary methods. There are two implications of this:

1) The results of the modified experimental design suggest that the FPHSP is relatively cost-effective; and

2) as programmes such as Bangladesh's attempt to develop a method mix with a larger role for temporary methods for use by women who are not sure whether they want to stop child-bearing, the cost of recruiting new acceptors and providing them with services is likely to increase. To substantiate these claims further, however, it is useful to estimate cost-effectiveness ratios outside the rubric of the experimental design.

4. MODEL III: THE NON-EXPERIMENTAL DESIGN

The purpose of this section is to suggest additional modifications to the above estimates for the treatment area which go beyond Models I and II, and to document the costs and effects of all family planning and related service activities in the comparison area.

4. 1. Model III: Costs

To assess the full costs of delivering services in the treatment area, the adjusted costs developed under Model II need to be further modified to include the costs of government workers assigned to the area.

Under an incremental cost approach, such as that used in Models I and II, workers' time would not be considered a cost, since they do not add any services to the residents in the area. Elsewhere in our sensitivity analysis we have considered the government's salaried family workers slotted into the study treatment area (Simmons, *et al.*, 1991). Here, however, we adopt the scenario presented by Koenig and colleagues (1992) that the government effort in the treatment area is artificially low, and, therefore, routine inclusion of an inactive programme would falsely bias upward the treatment area total cost estimates.

In the comparison area, the Model III "bookkeeping" costs are based on both the government and FPHSP's family planning effort, matching as much as possible the services in the comparison area with those provided by the project in the treatment area.

The cumulative cost of the MCH-FP activities from 1978 to 1985 is $403,867 (see Table 10), ranging from $44,526 to $69,830 annually. The FPHSP incurs about 10 per cent of the overall comparison area costs (excluding a fraction of overhead).

As a basis of comparison using Koenig, *et al.*'s scenario about the government effort in the treatment area, an estimate of the government cost in the treatment area might be as high as two per cent of total costs and are even lower if this indicates a minimum government effort (i.e. compensation fees only).

4. 2. Model III: Effects

The methods used for estimating the effects of services in the treatment and comparison areas are the same as those used in the Model II adjustments. Given age and the method-specific number of users for the two areas, we have estimated the number of SCYP and ABP generated in the two areas.

In the treatment area, the number of SCYP and ABP generated by the FPHSP is 28,074 and 6,288, respectively (Balk, *et al.*, 1988: Tables V-13 and V-15). There is about a 9 per cent difference in this estimate of births prevented from the estimate of 6,914 births prevented we get in Model I. In the comparison area, the government alone generates 8,298 SCYP and 1,684 ABP (not shown).

A comparison of the activities of the different agencies in the two areas is quite revealing: The FPHSP prevents over 3.7 times as many births in the treatment area as the government does in the comparison area.

Evidence suggests that the government programme does not generate any SCYP or ABP in the treatment area. The FPHSP, however, is responsible for some of the contraceptive use and fertility reduction in the comparison area. Thus, as in Model II, it seems appropriate to adjust for the effects of the FPHSP's

CONTINUED...

clinical activities for residents outside the treatment area, but since the Model III estimation is not done by way of an experiment, the adjustment is somewhat different.

The adjustment in Model II for the spillover effect involves adding credit to the FPHSP for sterilizations and IUDs provided to comparison area and non-study area residents.

However, to avoid duplicating credit for procedures already included in the prevalence figures of Table 2 (on which the above SCYP and ABP are based), the comparison area totals are adjusted downward to adjust for the spillover.

These adjustments yield 34,523 SCYP and 7,403 ABP by the FPHSP (Balk, *et al.*, 1988: Table V-16). Subtracting the effect of FPHSP services from the comparison area reduces the number of SCYP to 6,098 and ABP to 1,304 (Balk, *et al.*, 1988: Table V-17).

4. 3. Model III: Cost-effectiveness Ratios

To overcome the difficulties in measuring cost-effectiveness ratios based on the experimental model, we have independently estimated the costs and effects in the FPHSP treatment and comparison areas. This independent approach differs from the experimental model by distinguishing between the service providers.

CONTINUED...

Cost-effectiveness of the Matlab FP-HS

Under Model I, it is assumed that the government's health and family planning activities are similar in the treatment and comparison areas. What differentiates them is that the treatment area has the additional presence of the FPHSP.

The central question under the experimental model is to measure the extra cost and the effect associated with this additional presence. Under the non-experimental model, however, we make no such assumption and thus measure directly the costs and the effects of each of the two programmes.

The different models yield a wide array of cost-effectiveness estimates. In the treatment area, the average cost per ABP is $171 and in the comparison area is $298.

When more conservative estimates are made accounting even for rather high levels of government activities in the treatment area, cost-effectiveness ratios in the treatment area are still consistently lower than those in the comparison area (Simmons, *et al.*, 1991).

These results are not entirely representative of programme effort in Matlab. The relative absence of the government programme in the treatment area has implications for both cost and effect.

First and foremost, this absence makes for an over-estimate of the cost of the FPHSP treatment area services, since the project is devoting resources to the delivery of services that would normally have been provided by the government; second, the absence of the government programme means that the FPHSP has shouldered the responsibility of delivering some services that would otherwise have been provided by the places, such as the comparison area.

In measuring costs by non-experimental techniques, we found that almost 99 per cent of all MCH-FP-related costs in the treatment area from 1978 to 1985 were funded by the FPHSP (the remaining one per cent goes towards government compensation fees); and that about 10 per cent of all costs in the comparison area were attributable to the FPHSP. It is assumed that the government is the provider of the remaining funds.

Further, we found that the FPHSP is responsible for 100 per cent of the generation of demographic impact in the treatment area and 18.4 per cent in the comparison area (measured in terms of adjusted births prevented).

The treatment area is more cost-effective than is the comparison area, although the differences are not large.

More important is the observation that the treatment area has the same or similar cost-effectiveness while having a much higher level of effectiveness. This suggests that a shift to higher levels of contraceptive prevalence and services does not have to be associated with increasing cost per birth prevented.

5. CONCLUSIONS AND POLICY RECOMMENDATIONS

Table 12 (below) presents summary cost, effect, and cost-effectiveness information for all three models. The average cost per birth prevented by the FPHSP in the treatment area ranges from $158 to $180, from 1978 to 1985, depending on the range of activities and effects and the study design used to calculate the cost-effectiveness ratio.

Even the lowest of these estimates very likely under-estimates the effects of the project in terms of mortality reduction, improvements in reproductive health, and so on.

Although, in the aggregate, the FPHSP is more expensive than the government's family planning programme in Matlab, it is also considerably more effective, in that it delivers about three times

TABLE 12

A summary of cost-effectiveness ratios in Matlab, 1978-85, in constant US$

	Experimental and adjusted experimental models		Nonexperimental Models	
	Model I:	Model II:	Model III:	
	Pure experimental design Bookkeeping costs	Adjusted experimental design Adjusted costs/adjusted effects	Nonexperimental design	
Ratios	**Treatment area only**	**Treatment area only**	**Treatment area**	**Comparison area**
Core service cost	1,242,571	1,268,019	1,268,019	388,489
Effects				
CU, SCYP	29,674	36,123	34,523	6,098
BP, ABP[a]	6,914	8,029	7,403	1,304
Cost-effectiveness ratios				
Cost per CU or SCYP	42	35	37	64
Cost per BP or ABP	180	158	171	298

[a]Model I is the only model to make use of the unadjusted measures of effect (i.e., CU and BP).

CONTINUED...

Cost-effectiveness of the Matlab FP-HS

more services per eligible woman than delivered in the comparison area at the same (or lesser) cost per woman. By operating more intensively, the FPHSP generates enough output to offset the extra costs of the intensified delivery system. Alternative approaches to delivering health and family planning services should be explored in the hopes of finding a more effective, more efficient, or more administratively feasible intervention.

While the overall costs per birth prevented of the national programme are lower (based on independent estimates) than the estimates of the experimental and quasi-experimental design (Models I and II), the national costs for temporary methods are not much less than those in the FPHSP in Matlab. At the local level, however, the results of Model III suggest that the delivery of all methods in the treatment area is more cost-effective than the limited service provision in the comparison area. This suggests that the national programme can expand to include a variety of reversible methods in addition to terminal ones without incurring a significant rise in the cost per contraceptive user.

Finally, this analysis has highlighted that considerably more needs to be learned about the costs and cost-effectiveness of health and family planning interventions. A concerted effort to incorporate such issues in the design and maintenance of programmes and evaluations would benefit policy-makers and planners in the allocation of scarce resources aimed at reducing fertility and mortality in rural Bangladesh and elsewhere in the developing world. ■

CONTINUED...

Cost-effectiveness of the Matlab FP-HS

Families of several baris pose happily for a group photograph

CHAPTER 20

A Cost-effectiveness Analysis of the Matlab Family Planning-Health Services 1978-85

Deborah Balk, George B. Simmons & Khodezatul K. Faiz

Lessons learned ...

* *The economics of the Matlab Family Planning and MCH Project are more favourable than often suggested.*
* *The cumulative costs of the FPHSP from 1978 to 85 are about US$1.2 million, or about US$ 155,000 annual.*
* *This translates into about US$ 40 per contraceptive user generated and about US$ 160 per birth prevented (depending on the assumptions of the chosen estimate).*
* *The costs of a high intensity delivery system are significantly offset by extra acceptance and use of project services.*
* *The resulting cost per birth prevented in the Matlab project area is quite similar to or lower than that of the lower intensity government programme in the neighbouring area.*
* *The fact that the Matlab project approach delivers relatively inexpensive services with a method mix which places low emphasis on sterilization means that the result comes much closer to the long-term national goal of a high acceptance population with a broader contraceptive method mix; or is more efficient in achieving this goal than the government programme.*

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CHAPTER 21

Comparative Cost-effectiveness of MCH-FP Services in Matlab: 1986-1989

Nimal Attanayake
Vincent Fauveau
Jyotsnamoy Chakraborty

Most decisions taken by policy-makers and managers in relation to the provision of health care services are ultimately linked to the allocation and use of scarce resources. Irrational decisions would, therefore, lead to wastage of resources and hence involve a social cost.

Social cost arises mainly from the possibility of using a set of resources to achieve a set of objectives. Thus, minimization of costs with a given set of objectives or optimization of desired benefits with a given set of resources should become the guiding principles of any rational decision.

Although the outcomes of the health-care sector do involve a seemingly immeasurable human factor, economic analysis can play an important role in assisting policy-makers and managers in determining the best alternative through which the objectives of health interventions can be achieved.

In this context, cost-effectiveness analysis (CEA) can be used as an analytical tool to achieve these objectives. CEA involves a comparison between projects, programmes and activities, or between the various components within a given project, in terms of cost involved and output generated.

In this paper, an attempt is made to look into the cost-effectiveness of the Matlab Maternal and Child Health-Family Planning (MCH-FP) project for the 1986-1989 period with a view to assessing its economic viability.*

It is well documented that the Matlab project has been able to upgrade the health status of mothers and children in the area by introducing and maintaining a comprehensive package of family planning and MCH services (Bhatia, *et al.* 1980; Phillips, *et al.* 1982; Chen, *et al.* 1983; Fauveau, *et al.* 1990).

In 1986, the project was subjected to a CEA covering the 1978-1985 period, and an attempt was made to compare the cost of services with some effectiveness indicators related to both intermediate and final outcomes of the project (Simmons, *et al.* 1991; Balk, *et al.* 1988, see Chapter 20).

Part III

The text of this chapter is a slightly modified version of a paper published in Health Planning (1993; 8(4): 327-338, Oxford University Press), by the same authors, under the title "Cost-effectiveness of the Matlab MCH-FP Project in Bangladesh"". The authors wish to thank the field staff of Matlab and the Finance Officers of the ICDDR,B, as well as Kate Stewart, Andres de Francisco, Md Yunus, Shamim A. Khan, Farid Ahmad, and Mr Alauddin. Supporter and useful comments were given by Anne Mills, Julia Fox Rushby, Andrew Creese, Jeff Muschell, and Martin Desmets.

Three indicators were used in the CEA, namely contraceptive-users generated, births averted, and deaths averted. *It was concluded that the allegedly high cost of the project had been significantly offset by extra births and deaths prevented, and by improvements in reproductive health.*

Since the completion of the 1986 CEA, several new MCH interventions have been introduced, and the cost structure of the Matlab project has undergone significant changes.

During 1986-89, five new interventions were introduced: nutrition education and rehabilitation in 1986; maternity care in 1987; control of acute respiratory infections in 1988; vitamin A capsule distribution in 1987; and control of dysentery in 1989.

In addition, certain interventions which were initially confined to two blocks of the project area were extended to the two other blocks during this period.

As a result of these interventions, although some expenditure items, such as personnel, did not change much during this period, several new input items were added to the cost structure, making it more complicated. These new interventions also changed the time allocation pattern of the personnel involved in the project.

CONTINUED...
Comparative Cost-effectiveness of MCH-FP Services

Although in the 1986 study the economic effectiveness of the overall project was examined, no emphasis was put on the measurement of cost-effectiveness at activity level (with the small number of activities in operation at that time). In the present context, however, only a CEA at activity level would help decision-makers reach decisions concerning re-allocation of resources within the project itself and/or justify the decisions which had already been taken.

In this paper, an in-depth analysis of the cost structure of the Matlab project is attempted at activity level. An implied objective would be to assess the feasibility of replicating the project on a larger scale with due modifications, or to identify the measures through which the pre-specified objectives of the project could be achieved in a more efficient manner. The analysis is, however, confined to provider's cost and specifically to recurrent cost. This could be broadly defined as operational cost. Only cost items which are included in the annual budget of the Matlab project are taken into account in the cost analysis.

1. SOURCES OF DATA AND METHODS

1.1 Cost

Data pertaining to cost elements are readily available in the cost reports of the project. During the four-year period from 1986 to 1989, the project was supported by four concomitant budgets, and a monthly cost report was prepared for each budget.

The four budgets were MCH-FP (main budget), Vitamin A Capsule Distribution, Control of ARI, and Maternity Care.

There were nine activities or interventions in the project, namely:

1) Family Planning Programme (FPP);

2) Expanded Programme of Immunization (EPI);

3) Maternity Care (MAT);

4) Control of Acute Respiratory Infections (ARI);

5) Control of Dysentery (DYS);

6) Vitamin A Capsule Distribution (VAC);

7) Oral Rehydration Therapy (ORT) through home distribution of ORS packets;

8) Nutrition Education and Rehabilitation (NRU); and

9) Curative Services (CUR, including MCH-FP clinic activities in Matlab and the subcentres, with the exclusion of ARI, MAT, DYS, and ORT).

Since these activities and interventions were not supported by separate budgets, the cost reports for the four budgets mentioned above were carefully screened, and cost items in each report were classified into ten subgroups. Expenditures on research were included in the tenth subgroup.

Through this exercise it was found that many cost items had been related to several activities, and these had to be separated out. For instance, each drug item had to be identified in terms of what proportion was, in general, used for each activity.

Observations, discussions with administrative, clinical, field and other staff members of the project, and screening of log sheets (for example with regard to transportation) were undertaken to apportion multi-functional non-human cost items to the various activities in each year. To apportion the expenditure on salaries and wages to the various activities, a time-allocation study was undertaken by administering a questionnaire among all employees of the project, from field workers to the principal investigator.

However, the findings of the time-allocation study had to be adjusted because it was undertaken in late 1990 and hence provided information on the time-allocation pattern at that time. The structure of activities in that year was somewhat different from that of previous years. Figure 1 (below) shows the time at which each intervention or activity was introduced. The changes in time allocation having been considered, distributional proportions of human inputs among activities were adjusted to obtain a more realistic distribution pattern for each year.

Intervention	Initiated Year	Initiated in blocks	Cost-Effectiveness indicators
1. Family Planning (FPP)	1978	All	a) CPBA b) ICCPR c) ICIOC
2. Curative Services (CUR)	1978	All	**
3. Oral Rehydration Therapy (ORT)	1978	All	a) CPDA b) ICRMR c) Cost per ORS Packet distributed
4. Expanded Programme of Immunization (EPI)			
4.1 Measles vaccine	1982	A & C	a) CPDA b) ICRMR
	1986	B & D	c) IMCICR d) CPV
4.2 Tetanus vaccine a) To pregnant women only	1978	All	a) CPDA b) ICRMR
b) To all married women	1982	A & C	c) ICICR d) CPV
	1986	B & D	
4.3 DPT, Polio, and BCG	1986	All	a) ICICR b) CPI
5. Nutrition education & rehabilitation (NRU)	1986	All	a) CPDA b) ICRMR c) ICRMLR d) CPCT
6. Vitamin A Capsule Distribution (VAC)	1987	All	**
7. Maternity Care (MAT)	1987	C & D	a) CPDA b) ICRMR
8. Control of Acute Respiratory Infections (ARI)	1988	A & B*	a) CPDA b) ICRMR c) CPCT
9. Control of Dysentery (DYS)	1989	B & D*	a) CPDA b) ICRMR c) CPCT

CPBA = Cost Per Birth Averted; CPDA = Cost Per Death Averted; ICCPR = Incremental Cost to increase Contraceptive Prevalence Rate by one unit; ICIOC = Incremental Cost to Increase One more Contraceptive user; ICRMR = Incremental Cost to Reduce Mortality Rate by one unit; ICICR = Incremental Cost to Increase Coverage Rate by one unit; CPV = Cost Per Vaccine CPI = Cost Per Immunization; ICRMLR = Incremental Cost to Reduce Malnutrition Rate by one unit; CPCT = Cost Per Case Treated/Attended/Performed;
* Since referrals were made from other blocks this intervention covered, in fact, the whole treatment area ** Cost-effectiveness indicators were not measured for these interventions

Fig 1: Interventions and their cost-effectiveness indicators

CONTINUED...
Comparative Cost-effectiveness of MCH-FP Services

Costs of health services delivered in the Matlab Project have been in question in the recent years.

Another important question is to evaluate the respective cost and effectiveness of preventive and curative services.

All expenditures figuring in each annual cost report were condensed in a two-way table which illustrated the distribution of total expenditure among ten activities by five expenditure categories: wages and salaries; travel; drugs; supplies and equipment; and support services.

In this context support services are basically inter-departmental services, such as repair and maintenance, financial charges, printing charges, washing charges, staff development, and laboratory tests.

Some cost items which cannot be considered as recurrent costs were also included in these figures, for example purchase and construction of some fixed assets. Although such cost items were normally categorized under a separate heading in cost reports, a few have been included under operational costs.

1.2. Effectiveness

Data, such as cause-specific deaths, births, contraceptive prevalence, vaccine coverage, nutritional anthropometry, were used to measure effectiveness indicators. Data on births and deaths were obtained from the Matlab demographic surveillance system, while contraceptive data were obtained from the record-keeping system, and morbidity data were obtained from clinical performance reports from the Matlab Station and various other records from the Matlab project (see Chapters 4 and 5).

The Matlab demographic surveillance system also provided mortality and fertility data from the comparison area, the neighbouring area receiving services from the government health system with which most comparisons were made.

Details of the Matlab MCH-FP Project, including a map and the location of operational blocks are found in Chapters 3 and 4. Details of project inputs and mortality impact are found in Chapters 6 to 12, and in Fauveau, *et al.* (1990, 1991, 1992).

1.3. Cost-effectiveness Indicators

Three types of cost-effectiveness indicators (CEIs) were measured: 1) cost per birth/death averted; 2) incremental cost to reduce/increase an effectiveness indicator by one point; and 3) average cost to attend/perform/treat one case (see Figure 1).

1.3.1. Cost per death or birth averted

For NRU, ORT, EPI and FPP, the measurement of the number of deaths or births averted in relation to the comparison area was straightforward, because these interventions have been implemented equally in all blocks of the treatment area since 1986. For control of ARI and DYS, the same method of comparison was adopted because, although these interventions were fully implemented in only two blocks, patients were referred from the other two blocks to the subcentres of the project and to the Matlab clinic as part of the intervention.

For MAT, however, the number of deaths averted was measured in relation to Blocks A and B because this intervention was implemented in Blocks C and D only. Moreover, for MAT, the number of deaths averted took into account not only maternal deaths but also neonatal deaths averted by the service programme. No CEIs were measured for the interventions CUR and VAC because of the impossibility to quantify their effect.

1.3.2. Incremental cost to reduce or increase an effectiveness indicator of an activity by one point

(IC) in a particular year was measured by dividing the marginal increase in its cumulative cost figure by the absolute change in the corresponding indicator in that year.

However, the strict economic meaning of marginal cost cannot be applied to variations in IC in the present case, because the process of generating outcomes in these health interventions is significantly different from that of a normal physical production unit. For activities like EPI and family planning, for example,

CONTINUED...

there always exists an upper limit for intermediate outcomes, such as full coverage.

Further, for many health interventions there always exists a lower limit for their final outcome (except the improvements in health status), that is zero cause-specific mortality rate. Continuation of any such intervention with the generation of a higher coverage rate and/or prevention of deaths should necessarily lead to the IC being brought down to a certain point.

However, for any intervention, a cost has to be incurred even to maintain the satiety level (the level at which the expected health outcome has been achieved). Nevertheless, with no significant technological changes in most interventions of the Matlab project, there should be a decrease in IC in all of them at a certain point.

1.3.3. Average cost per case attended/performed/treated (AC) was simply the result of the total cost of an intervention divided by the number of individuals having used this service. Cost per case treated was calculated for ARI, DYS and NUT. For EPI it was the cost per immunization performed, and for ORS the cost per case offered ORS packets.

2. RESULTS

2.1. Costs

CONTINUED...
Comparative Cost-effectiveness of MCH-FP Services

2.1.1. Composition and Growth by component

Table 1 (facing page) shows that during the relevant period approximately 40 per cent of the total expenditure of the Matlab project was allocated to research, and the rest to delivery of services.

Among the cost components of service delivery, wages and salaries showed the highest percentage with 70.8 in 1989, which is about 6 per cent less than in 1986. The component of support services almost doubled, going from 8.2 per cent in 1986 to 15.8 per cent in 1989. All other components demonstrated substantially constant shares throughout the period.

While in 1989 the cost of travel stood at around 0.5 per cent, drugs and supplies and materials were reported to be around 5 per cent and 8 per cent respectively. Cost of travel had a very low share because a large portion of total expenditure on travel (called "transport") was related to research and hence was added to the share of research expenditure.

The average cost per head of population of the service components of the Matlab MCH-FP project varied from US$ 2.0 in 1986 to US$ 3.5 in 1989. During the relevant period, the total cost of the Matlab project increased at an annual rate of 22.5 per cent at constant prices. While expenditure on research showed a growth rate of 23.7 per cent, service-related expenditure grew at a rate of 21.6 per cent. Among service-related expenditure items, the highest growth rate recorded (50.9 per cent) was for support services. Expenditure on drugs recorded the next highest growth rate at 24.4 percent; its value almost doubled between 1986 and 1989. Three other components, namely wages and salaries, travel, and supplies and materials, recorded growth rates of 18.4, 20.6 and 13.0 per cent, respectively.

2.1.2. Composition and Growth by Activity

When total expenditure was apportioned according to the ten activities including research (Table 2, overleaf), the greatest share was taken by research activities, with around 40 per cent of all costs. When expenditure was restricted to service activities, the greatest share was taken by family planning (FPP). This share, however, declined significantly, from 17.8 per cent in 1986 to 14.5 per cent in 1989. While CUR, EPI and NRU appear to have the next highest shares respectively, these three activities also demonstrated a gradual decline in their shares. Overall, no service activity recorded an increase of its cost share between 1986 and 1989. This pattern is not, however, an unhealthy sign because the introduction of new activities after 1986 had naturally brought down the relative significance of existing activities within the total budget.

TABLE 1

Costs of the Matlab MCH-FP project by component, 1986-1989 (US $)

Component	1986	1987	1988	1989	Growth Rate*
a) AT CONSTANT PRICES**					
1. Wages and salaries	150,761	187,725	199,533	249,890	18.4
2. Travelling	1,057	1,211	1,494	1,856	20.6
3. Drugs	9,462	11,709	10,691	18,204	24.4
4. Supplies & materials	18,970	18,258	23,337	27,380	13.0
5. Supportive services	16,186	24,468	35,413	55,636	50.9
Sub total: service related cost components	196,436	243,371	270,468	352,966	21.6
(Percentage)	(58.6)	(60.8)	(60.3)	(57.3)	
6. Research	138,970	156,614	178,270	262,945	23.7
(Percentage)	(41.4)	(39.2)	(39.7)	(42.7)	
TOTAL	**335,406**	**399,985**	**448,738**	**615,911**	**22.5**
b) PERCENTAGES OF SERVICE RELATED COST COMPONENTS					
1. Wages and salaries	76.7	77.1	73.8	70.8	
2. Travelling	0.5	0.5	0.6	0.5	
3. Drugs	4.8	4.8	4.0	5.2	
4. Supplies & materials	9.7	7.5	8.6	7.8	
5. Supportive services	8.2	10.1	13.1	15.8	
TOTAL	**100.0**	**100.0**	**100.0**	**100.0**	

** Exponential growth rate*

*** Exchange rate of Taka was used for the conversion (1989=100)*

CONTINUED...

Comparative Cost-effectiveness of MCH-FP Services

TABLE 2

Cost of the Matlab MCH-FP project by activity, 1986-89 (US $)

Activity	1986	1987	1988	1989	Growth Rate*
a) AT CONSTANT PRICES**					
1. FPP	59,827	65,329	74,860	89,351	14.3
2. EPI	31,803	33,879	38,476	45,147	12.4
3. ORT	14,956	15,425	17,968	22,308	14.3
4. ARI	0	0	31,513	33,346	5.8
5.MAT	0	25,542	28,111	36,550	19.6
6. NRU	44,410	47,909	37,350	44,303	-0.1
7. VAC	0	12,907	11,764	13,849	3.6
8. CUR	45,440	42,380	30,426	48,297	2.1
9. DYS	0	0	0	19,815	----
10. Research	138,970	156,614	178,270	262,945	23.7
TOTAL	**335,406**	**399,985**	**448,738**	**615,911**	**22.5**
b) PERCENTAGES					
1. FPP	17.8	16.3	16.7	14.5	
2. EPI	9.5	8.5	8.6	7.3	
3. ORT	4.5	3.9	4.0	3.6	
4. ARI	0.0	0.0	7.0	5.4	
5. MAT	0.0	6.4	6.3	5.9	
6. NRU	13.2	12.0	8.3	7.2	
7. VAC	0.0	3.2	2.6	2.2	
8. CUR	13.5	10.6	6.8	7.8	
9. DYS	0.0	0.0	0.0	3.2	
10. Research	41.4	39.2	39.7	42.7	
TOTAL	**100.0**	**100.0**	**100.0**	**100.0**	

** Exponential growth rate*
*** Exchange rate of taka was used (1989=100)*

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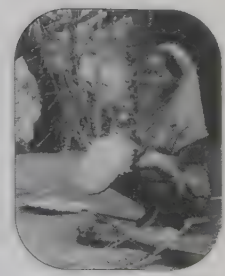
Comparative Cost-effectiveness of MCH-FP Services



Growth rates at constant prices of the total cost of activities provide a better picture of the changes which took place in the cost structure. As Table 2 indicates, positive growth rates were recorded for all service activities except NRU.

Maternity care (MAT) recorded the highest growth rate with 19.6 per cent, followed by FPP and ORT with 14.3 per cent each. As the detailed cost reports indicate, the prime reason underlying this tendency was the relatively high increase in the cost of support services and supplies and materials in each activity.

2.2. COST-EFFECTIVENESS INDICATORS

2.2.1. Cost per death averted (CPDA)

Among the six activities for which CPDA was computed, EPI, which was restricted to its measles and tetanus components in this analysis, was the most efficient (Table 3, overleaf). In terms of the number of deaths averted, a total of 101 for measles and 100 for neonatal tetanus was recorded.

In terms of cost, for the under-five age group, CPDA was $201 for measles and $294 for neonatal tetanus. Moreover, apart from a few cases, annual increases in the CPDA of EPI appear to be relatively lower than the annual increases of almost all other interventions.

The only exception is the sharp increase in CPDA for neonatal tetanus between 1988 and 1989. One reason for this increase might be the intensification of EPI activities in the comparison area in 1989 by the Government of Bangladesh, which resulted in a sharp drop in its neonatal tetanus mortality rate.

Of the other five activities, control of ARI appears to be the next efficient with the second lowest CPDA. On average, $717 was spent to avert a single death from ARI.

CPDA was computed for two age sub-groups: one to four-year olds and post-neonates (one to eleven months). Neonates were not considered in this analysis in view of diagnostic uncertainties concerning neonatal pneumonia.

The highest number of deaths averted (42) was reported for post-neonates, with a CPDA of $310. Although the CPDA in the one to four age group appears to be the highest for the whole period, it dropped sharply from $4,341 in 1988 to $1,375 in 1989.

Control of dysentery (DYS) was the next efficient activity with 20 deaths averted for a CPDA of $997. In contrast to ARI, CPDA for post-neonates was very high: $2,246 with only two deaths averted. Nonetheless, the dysentery mortality rate among post-neonates was extremely low in both areas.

Children in the one to five age group were the most affected by this intervention, with 18 deaths averted for a CPDA of $855.

Maternity care appears to be a less efficient activity in terms of CPDA. Compared to Blocks A and B, MAT averted a total of 42 direct obstetric and neonatal deaths with a CPDA of $2,158.

NRU was associated with a total number of 99 deaths from severe malnutrition averted during the four-year period.

This high number takes into account deaths from persistent diarrhoea associated with malnutrition, one of the most common causes of child mortality in Matlab.

However, NRU's cost component seems to be relatively higher than that of most other interventions, as indicated by its CPDA of $1,757. Moreover, the effectiveness rate of this intervention shows a continuous annual decline, from 36 deaths averted in 1986 to ten in 1989. This resulted in a sharp increase in its CPDA to $4,665 in 1989.

ORT demonstrated mixed results, with positive *as well as* negative effectiveness rates in different years, indicating that the intervention was, in fact, not so effective in certain years for certain age groups.

CONTINUED...
Comparative Cost-effectiveness of MCH-FP Services

TABLE 3

Cost-effectiveness indicator I-cost per death/birth averted by intervention*, Matlab MCH-FP project (US $)

Intervention/ Activity	1986		1987		1988		1989		1986-89	
	No. of Deaths averted	Cost per death averted	No. of Deaths averted	Cost per death averted	No. of Deaths averted	Cost per death averted	No. of Deaths averted	Cost per death averted	No. of Deaths averted	Cost per death averted
ARI										
1. Under 5 years					49	648	42	796	91	717
2. 1 - 4 years					6	4,341	19	1,375	24	2,057
3. Post-neonates	23	284	20	339	42	310				
DYS										
1. Under 5 years							20	997	20	997
2. 1 4 years							18	855	18	855
3. Post-neonates							2	2,246	2	2,246
NRU										
Under 5 years	36	1,246	31	1,530	22	1,674	10	4,645	99	1,757
ORT										
1. Infants	3	1,226	4	826	(9)	10	479	8	1,903	
2. 1 - 4 years	3	3,858	(3)	3	3,993	(2)	1	38,596		
Total	6	2,408	2	7,050	(5)	9	2,462	13	5,578	
EPI										
1. Measles										
Under 5 years	34	140	20	138	24	255	24	284	101	201
2. Neonatal tetanus	27	144	30	249	28	281	14	724	100	294
MAT										
Compared to Blocks A&B	16	1,631	10	2,782	17	2,205	42	2,158		
FPP	No. of Births averted	Cost per birth averted	No. of Births averted	Cost per birth averted	No. of Births averted	Cost per birth averted	No. of Births averted	Cost per birth averted	No. of Births averted	Cost per birth averted
Compared to comparison area	841	71	903	72	1,256	60	1,343	67	4,343	67

** at constant prices (1989=100)*
NA=not available
Note: brackets indicate negative numbers

This result is partly due to some measurement errors: although on a less intensive basis, the intervention was implemented in the comparison area as well, through the distribution of ORS packets by CHWs and the promotion of the use of home-made solutions.

Further, unlike many other activities, ORT does not show an upward trend in its effectiveness rates; it is a relatively old and stabilized intervention. In view of the inconsistency in this mortality pattern, interpretation of the calculated CPDA should be made with caution.

2. 2. 2. Cost Per Birth Averted (CPBA)

Relative to the comparison area, in the period 1986-89 altogether 4,343 births were averted by the Matlab project with an average CPBA of $67 (Table 3, facing page).

There was an *upward* movement in the number of births averted: an increase from 841 in 1986 to 1,343 in 1989. Moreover, CPBA showed a *decline* from $71 in 1986 to $60 in 1988.

These figures are relatively lower than the figures of Balk, *et al.* (1988) for the period up to 1985. This is largely due to the broader definition of cost adopted in Balk's study.

In any case, the reported CPBAs cannot be directly compared with CPDAs of other interventions because they have different meanings, dimensions and implications.

2. 2. 3. Incremental cost (IC)

Wide variations in IC can be observed between interventions and within interventions (Table 4, overleaf).

The top part of the table relates to the reduction of cause-specific mortality by one point and shows, for example, that — for malnutrition (NRU) — while mortality rates declined from 4.4 in 1986 to 3.3 in 1989, IC to reduce this rate by one point declined from $114,553 in 1987 to $93,072 in 1989.

The second part of the table shows an IC reduction of one per cent the malnutrition prevalence rate in the community, assessed by a Mid-Upper-Arm Circumference (MUAC) of less than 110 mm. While the malnutrition rate declined substantially, from 15.3 per cent in 1987 to 7.1 per cent in 1989, its IC remained fairly constant at around $10,000 throughout the period.

The third part of the table relates to the EPI coverage rate. Although there was a marginal increase in the coverage rate of each of the four components of EPI in each year, IC remained more or less constant for measles and tetanus toxoid, increased for BCG, and decreased somewhat for DPTP. For measles, TT and DPTP, the decline in IC in 1988 could be largely due to the relatively high increase in coverage rates of all the three activities in that year.

The bottom part of Table 4 relates to the family planning programme (FPP). While the contraceptive-use prevalence rate increased steadily from 46.4 per cent in 1986 to 56.5 per cent in 1989, IC appears to have increased in 1988 and then returned close to the 1987 figure in 1989. IC to increase one more contraceptive user followed the same pattern.

2. 2. 4. Average cost per case

The average cost (AC) per case treated/performed/attended was computed for five activities: ARI, DYS, NRU, ORT, and EPI. As shown in Table 5, (overleaf) AC figures for all activities increased between 1987 and 1989. Of all activities, NRU can be considered the most expensive with more than US$400 per case treated on average. ARI shows a cost of around US$40 per case treated.

The AC figures of EPI and ORT appear to be reasonably low, with around US$2 and US$0.1 being spent per immunization and per ORS packet distributed respectively.

One reason for the low AC for EPI and ORT seems to be the lower cost of delivery with the system of delivering more than

CONTINUED...
Comparative Cost-effectiveness of MCH-FP Services

TABLE 4

Cost-effectiveness indicator II - incremental cost to reduce/increase an effectiveness indicator by one unit* Matlab MCH-FP project (US $)

Intervention/Activity	1986		1987		1988		1989	
	Rate	Incremental Cost	Rate	Incremental Cost	Rate	Incremental Cost	Rate	Incremental Cost
1. TO REDUCE THE MORTALITY RATE RELATED TO:								
ARI					3.6	NA	2.7	38,602
DYSENTERY							0.6	26,525
MALNUTRITION (NRU)	4.4	NA	4.0	114,553	3.7	140,207	3.3	93,072
ORT	1.3	NA	1.6	-----	2.0	-----	1.2	22,945
MATERNITY CARE** (Only in Blocks C&D)	59.3	NA	40.5	1,359	42.2	-----	40.7	24,110
EPI								
a. Measles	0.5	NA	0.1	5,706	0.4	-----	0.1	15,387
b. Neonatal tetanus	3.9	NA	2.1	4,100	1.6	16,186	0.6	10,427
2. TO REDUCE MALNUTRITION RATE (NRU)+: Among children between 6-60 months	19.9	NA	15.3	10,516	11.1	8,860	7.1	11,236
3. TO INCREASE THE COVERAGE RATE OF EPI:								
a. Measles	78.6	NA	80.7	1,299	87.1	950	91.9	1,435
b. Tetanus toxoid	87.6	NA	89.1	5,042	91.7	3,081	93.6	5,143
c. DPTP	55.7	NA	57.7	7,740	64.8	2,578	72.2	2,923
d. BCG	28.8	NA	78.0	165	84.7	909	89.1	1,558
e. Criterion I (a,b,c&d)#	57.6	NA	75.4	1,988	81.4	6,580	86.2	9,253
f. Criterion II (a&b)#	83.0	NA	84.8	5,660	89.4	3,080	92.7	4,935
4. TO INCREASE THE PREVALENCE RATE OF CONTRACEPTIVE USE##: (To increase one more contraceptive user)	46.4	NA	49.8	19,027	51.9	35,747	56.5	19,247
		NA		(74)		(133)		(97)

** at constant prices (1989=100)*

*** direct obstetric and neonatal deaths*

+ percentage of children between 6-60 months with MUAC < 110

 # Criterion I = Geometric mean of the coverage rates of Measles, MM. DPTP and BCG

 # Criterion II = Geometric mean of the coverage of Measles and TT

per 100 eligible women

— indicates incapability of measuring incremental cost as the rate has gone up during the year concerned

NA=not Applicable

one unit of EPI or ORS packet to the same user/patient at the same time. As indicated in the above section, for interventions like EPI, however, the upward movement in cost per immunization is easily understood as it had already reached closer to its satiety level.

3. DISCUSSION

The present comparative cost-effectiveness analysis of MCH and FP activities in Matlab was examined by using deliberately simplified methods. Only the recurrent cost incurred by the provider on service delivery was investigated.

TABLE 5

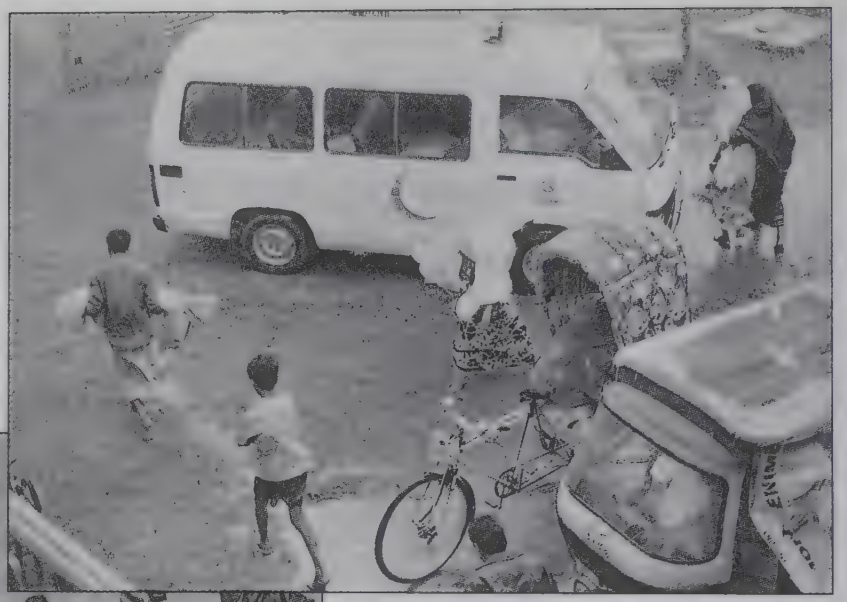
Cost-effectiveness indicator III - average cost to attend/perform/treat one case by intervention, Matlab MCH-FP project (US$)

Intervention/Activity	1986 Average Cost	1987 Average Cost	1988 Average Cost	1989 Average Cost
1. COST PER CASE TREATED				
ARI				
a. For cases treated at home			35	46
b. For all cases including OPD and hospitalized cases			32	41
DYSENTERY				
a. For all cases treated at home or sub centres or admitted in Matlab Clinic				46
MALNUTRITION				
a. For cases treated at Matlab Centre	673	386	424	554
2. PER ORS PKT. DISTRIBUTED	0.10	0.08	0.09	0.11
3. PER IMMUNIZATION				
Measles	1.7	1.8	2.1	2.5
Tetanus toxoid	1.4	1.8	2.1	2.5
DPTP	1.4	1.8	2.1	2.5
BCG	1.7	1.8	2.1	2.3

** at constant prices (1989=100)*

CONTINUED...
Comparative Cost-effectiveness of MCH-FP Services

Patients are brought to the Matlab hospital by rickshaw, baby taxis and by boat. They are also brought by ambulances and speedboat ambulances the maintenance costs of which add significantly to operating costs.



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Comparative Cost-effectiveness of MCH-FP Services

Thus the costs of certain inputs, such as contraceptives granted by external agencies to the project, were inevitably excluded. Since these inputs were provided free of charge throughout the study period, their exclusion from the cost analysis was assumed to have had no significant effect on comparisons made over the relevant period.

Rental values and depreciation were also excluded on the assumption that there exists no significant differences among the activities with respect to capital intensity. The only exception is curative services, but no CEIs were computed for these.

Confining the cost analysis to the service-delivery system naturally excluded the social cost. However, most services in the Matlab project are being provided at the doorstep by CHWs, and the cost borne by the users of these services is extremely low. One exception to this is the cost in terms of time lost when users of nutrition rehabilitation stay with their child at the centre until the end of the rehabilitation period.

Although the opportunity cost of mothers in Matlab still remains an area for research, resistance was observed among some mothers in complying with referrals, particularly for NRU.

This observation indicates that the CEIs could have been somewhat different if social cost had been measured and added to the analysis. However, NRU was found to be one of the least cost-effective activities even if the present evaluation was confined to provider's cost.

In this simple analysis, cost-effectiveness was measured separately for each intervention. CPDA and CPBA were measured with respect to the comparison area using cause-specific death rates and birth rates, respectively.

A number of assumptions were deliberately accepted to pursue the analysis: It was assumed that the cause-specific death rates provided by the project were accurate enough. It was also assumed that deaths averted by the various interventions had the same value, and that the decrements of the various indicators chosen had comparable values.

Incremental cost and average cost were measured with the particular intention of indicating the productivity of interventions with respect to the generation of intermediate health outcomes. One of the limitations in this methodology was that there was no examination of interactions among interventions in relation to the generation of health outcomes.

Concepts of competing risks and frailty would be important factors in measuring more realistic CEIs (Mosley & Becker, 1991). In this context, vitamin A capsule distribution and NRU interventions could certainly have had indirect positive impact on the cause-specific death rates of other interventions.

Similarly EPI (measles vaccination) might have had an impact on deaths due to ARI and dysentery. There is, therefore, a need for further improvements in the methodology of CEA to distinguish the influence of each MCH intervention on the health and survival of the target population. If these considerations had been incorporated into the present analysis, the results might have been different. However, the presentation of results in that format would have been extremely complex.

CONTINUED

Another relevant point is the importance of measuring the impact of multiple interventions on selective CEIs as was attempted in the Narangwal study (Kielmann, *et al.*, 1983). Since all the interventions in the present case are health components, there is enough scope in a CEA to identify the impact of various combinations on health status. Such an attempt is particularly important for policy-making.

Moreover, indirect effects on the quality of life gained by the users through interventions, such as FPP or MAT, could be

considered as another important area to be examined in an economic evaluation. With the availability of a systematically collected set of data for the Matlab project these issues could be addressed in future research.

The methodology used in this study to measure incremental cost should be treated with caution. Measurement of IC became complicated because a portion of the increment in the total cost of any activity in any given time period was always related to the maintenance of the coverage rate/ mortality rate which had already been achieved at the beginning of the relevant period.

In this study, however, there was no attempt to apportion the IC into those two components, and the interpretation of IC should, therefore, be made with caution. The methodology of measuring IC could be further developed to incorporate the impact of multiple interventions. In such an exercise, the cost of maintaining each intervention at the level already acquired should also be adjusted to express incremental results.

With the indicators used in this study, it appears that the Matlab MCH-FP project was able to generate a significant impact on maternal and child health in the intervention area during the relevant period. Of the nine service activities, EPI had moved the closest to satiety level, and therefore the cost involved in this intervention had tended to move upwards. However, a significant portion of this upward movement should be attributed to the cost of maintenance, which was not measured in this study. This adjustment is necessary not only for EPI but also for other interventions, and this could be an area for further research.

CONTINUED...
Comparative Cost-effectiveness of MCH-FP Services

Compared to other interventions, FPP, ARI and DYS appear to have generated relatively high cost-effectiveness, either by way of decreasing incremental cost or with the achievement of low average costs.

When all indicators examined in this study are taken into consideration, MAT, ORT, and particularly NRU appear to have relative disadvantages in reaching a status of economic effectiveness. However, all these interventions have indirect effects on the health status of the target population. Maternity care in particular appears to have a considerable indirect impact on child health.

To sum up, the conclusions based on the findings of the present study should be treated with caution. Nevertheless, one implication of the findings is the necessity to reorganize the activities which have already reached close to satiety level by way of restructuring the present resource allocation pattern.

By doing so, a portion of both human and non-human resources allocated to those activities can be diverted to new interventions or to existing activities which have now a less economically efficient status. Such a reallocation of resources should, however, be based on a feasibility study. A guiding principle for resource reallocation would be to retain the minimum volume of resources within those activities to maintain the health outcomes which have already been achieved. This is extremely important for EPI.

In general, the measured values of CPDA, CPBA and AC seem to be comparable with the findings of similar studies undertaken in developing countries, such as those of Creese (1983), Shepard, *et al.* (1986), Phillips (forthcoming) and Robertson, *et al.* (1985). However, the cost figures of all these studies should be subjected to adjustments before a meaningful comparison might be undertaken, and this is outside the scope of this study. Yet the impression at first glance is that Matlab figures do not show significant differences with other studies.

The adoption of a more comprehensive cost-effectiveness analysis, and the addition of a cost-benefit analysis, both requiring sophisticated methodologies addressing the issues mentioned above, would no doubt produce useful findings, perhaps leading to more appropriate policy conclusions. It is hoped that health economists will further develop research methods and pursue the economic analysis of health programmes. ■

CHAPTER 21

Comparative cost-effectiveness of MCH-FP services

Nimal Attanayake, Vincent Fauveau & Jyotsnamoy Chakraborty

Lessons learned and recommendations

The present analysis was restricted to comparing costs and effectiveness of a series of health interventions implemented during a single period in a single study area.

Costs were restricted to the cost of providing services and recurrent costs, while effectiveness was measured by cause-specific mortality rates, coverage rates, and use prevalence rates. The choice of these indicators was based on assumptions guided by simplification, which may not hold in real life.

Three types of cost-effectiveness indicators were used: cost per death or birth averted, incremental cost to reduce or increase effectiveness indicators by one point, and average cost to treat one case or attend one client.

The comparison shows that costs per components, staff salaries and the cost of research share almost equally 80 per cent of the total project cost, while support services, supplies, drugs and travel share the remaining 20 percent.

When comparing the costs of service activities, activities can be ranked in the following decreasing order: family planning, nutrition rehabilitation, curative services, immunization, control of acute respiratory infections, maternity care, oral rehydration therapy, control of dysentery, and vitamin A capsule distribution.

When comparing cost per death averted among service activities for which this indicator can be measured, and according to the assumptions, immunization appears to be the most cost-effective, followed respectively by control of acute respiratory infections, control of dysentery, nutrition rehabilitation, maternity care, and oral rehydration therapy.

The cost per birth averted by the family planning programme (around US$67 during the study period) cannot be compared with any other activity.

Incremental costs to reduce or increase effectiveness indicators by one point are better used to assess variations over time (years) of given service activities. The use of this indicator is clouded by two issues: the reaching of satiety levels for some activities (immunization, family planning), and the cost of maintaining effectiveness at existing levels.

Although the comparison of average costs per case treated or attended must be interpreted with caution, it appears that nutrition rehabilitation is the most expensive, treatment of acute respiratory infection or dysentery is ten times less expensive, immunization is about ten times less expensive than the latter, and distribution of ORS packets is again about ten times less expensive.

The above analysis was simplified and did not, for example, take into account the interactions between service activities, or the indirect effects of some activities on apparently unrelated indicators.

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These old tin containers, once used to carry intravenous fluids, are no longer used in Matlab. They have found a new function...

CHAPTER 22

Matlab and the Bangladesh Family Planning & Health Programme

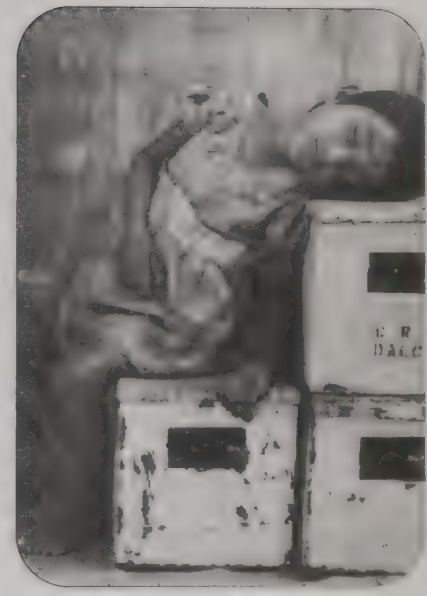
James F. Phillips

Prescriptions for policy change pervade the research literature on population programmes. While the audience for such conclusions may be receptive to the wisdom imparted, established bureaucracies resist systemic renewal and reform. Even if policies are modified in response to research, the promulgated changes often fail to influence what public-sector programmes actually do, since bureaucratic traditions outweigh reasoned responses to research outcomes.

This is particularly problematic where programmes have matured as complex bureaucracies before an operational model has been developed with demonstrable potential for making an impact on fertility dynamics. For research in such settings to influence implementation, findings must identify not only what ought to be done differently, but also how bureaucratic changes can be induced and sustained.

That much of the applied research in population is never, in fact, applied to policy development is well-known: operations research, however, well targeted on practical organizational issues, often fails to affect operations. Policy research findings, however, well focused on relevant policy themes, often fail to overcome the bureaucratic inertia of public-sector programmes. Nonetheless, eliminating the gaps between research, policy and implementation is rarely the subject of systematic inquiry.

The studies in Bangladesh reviewed in this article* address the need for a paradigm that not only conducts operations research, but also fosters its use. The literature on this theme spans the fields of organizational theory, change and development with applications in the fields of agriculture, manufacturing, commerce and human services (Glaser, *et al.*, 1983).



Part IV

This chapter is a slightly modified version, reproduced with permission of the Economic and Scientific Commission for Asia and the Pacific, of a paper by the same author published in 1987 in the Asia-Pacific Population Journal 2(4):3-28, under the title:* ***Translating pilot project success into national policy development: two projects in Bangladesh.* *The author would like to acknowledge with gratitude the assistance of M. Badrud Duza of the International Centre for Diarrhoeal Disease Research, Bangladesh (ICDDR,B) in preparing this article. Research work on the field experiment described in this article was funded by grants to ICDDR,B and the Population Council by the United States Agency for International Development.*

While even a cursory review is beyond the scope of this brief report, the experience of two studies in Bangladesh have been informed by this perspective and may be relevant to research planning and population policy development elsewhere (Phillips, *et al.*, 1984).

For three decades, Bangladesh population policies have aimed to reduce rates of rapid population growth through the dissemination of contraceptive services.

Although modest increases in contraceptive prevalence have been reported in recent years, demographic impact has fallen far short of official goals (Mitra and Associates, 1983; 1985). Debate focuses on the question of whether this experience represents a policy failure — suggesting that the reliance on contraceptive services is a misdirected effort, or an implementation failure — suggesting, in turn, that existing demand for services is inadequately addressed by the national programme.

Reliance on research to resolve such fundamental issues has been minimal, not only in Bangladesh, but also in similar settings where the central direction of policy is the subject of discussion and debate.

Moreover, where implementation has failed and where operations research is, thus, presumably needed most, research results typically contribute least to programme development. Weak implementation capabilities are associated with weak capacities to use research.

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What, then, can be done to develop non-functioning programmes in settings where the demand for contraceptive services is limited?

No setting is more appropriate for investigating this question than Bangladesh. With a population that currently exceeds 100 million, and annual growth rates that exceed 2.5 per cent, it is the most densely populated country in the world, and among the poorest.

Bangladesh's social and economic institutions perpetuate high fertility; natural calamities, political upheaval and economic adversity perpetuate these institutional constraints to the modernization of reproductive behaviour.

Although recent evidence suggests that contraceptive prevalence is increasing, the modest changes observed are consistent with the view that contraceptive services will not succeed in Bangladesh because the institutional climate is unfavourable to widespread fertility regulation.[1]

Quite apart from the societal constraints to the demand for contraception, there are severe organizational constraints to effective service delivery: outreach is sporadic, supervision is weak, staff training is poor, the range of available methods is limited and paramedical support is inadequate.[2]

Structural problems obstruct lines of authority and weaken co-ordination and control.

Officially, the Government of Bangladesh has a multi-sectoral multi-ministerial programme with components addressed to demand generation as well as contraceptive service delivery.[3] The sources and activities of the national programme are nevertheless concentrated in the Family Planning Division of the Ministry of Health and Family Planning, where links to the

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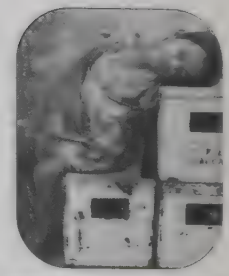
[1] For a review of the institutional constraints to fertility regulation in Bangladesh, see Arthur and McNicoll, 1987. The implications of these constraints for supply-oriented policies are reviewed by Demeny, 1975, and by Phillips, et al., 1985 and 1987.

[2] By most assessments, the operational limitations of the programme cited in the Second Five Year Plan (Ministry of Planning, 1983, p.349; and 1985) persist into the period of the Third Five Year Plan. See, for example, Koblinsky, et al., 1984

[3] A useful review of the structure and design of the Ministry of Health appears in MCHFP, 1985. The policy changes over the post-independence era have been reviewed by Duza, 1985.



health-delivery system, the political system and development resource are weak.

The structural changes introduced over time have more typically involved the adding of components and functions to the bureaucratic vestiges of earlier policies, than the restructuring of operations in response to research (Duza, 1985).

This pattern of uninformed programme evolution changed with the development of the recent Third Five-Year Plan. Research findings from two rural projects informed changes in the national policy process, and subsequently guided the implementation of revisions in the Ministry's programme (Phillips, *et al.*, 1986; Simmons, *et al.*, 1987).

Taken together these projects and their contribution to the Third Plan constitute a research paradigm that may be termed "implementation-based policy development."[4] The design of these projects, their contribution to policy and the lessons from this experience are reviewed in this article for applied research activities elsewhere.

1. DEVELOPING A SERVICE MODEL

For operations research to foster planned change where programmes have been developed prematurely, an operational model is needed that generates commitment to undertake change by providing a credible alternative to existing operations. Such a working model is exemplified by the Matlab Project.

1. 1. Origins of the Matlab Project

Established in 1977 as an experiment to ascertain whether family planning service could succeed in unfavourable societal contexts, Matlab functions as an autonomous project, isolated from the formal government bureaucracy and insulated from operational constraints which hamper implementation.

This isolation was necessary to protect the logical integrity of the design: demonstrating success in Matlab would require research showing the existence of contraceptive demand that can be activated with an appropriate system of supply. Demonstrating that services fail would require a design that minimizes the range of interpretations of failure, and hence an experimental system of supply that is sufficiently rigorous to avert the argument that failure arises from flawed implementation.

Matlab is a field research station of the International Centre for Diarrhoeal Disease Research, Bangladesh (ICDDR,B). Located in an isolated rural riverine subdistrict 35 miles to the south of Dhaka, Matlab is in many respects typical of the ecological, social and economic situation in the vast deltas of the Meghna and the Padma rivers.

Economic deterioration, famine, political upheaval and environmental adversity have prevented the development of towns, slowed the introduction of modern amenities and social services, perpetuated poverty and sustained high mortality. These adverse circumstances nevertheless enhance the importance of Matlab research, since success there lends credence to the hypothesis that family planning can work, even in unpromising societal settings.

Research on contraceptive service delivery in Matlab was not initially successful, however. An earlier project, known as the Contraceptive Distribution Project (CDP) was conducted during 1975-1977 to test the hypothesis that household distribution of oral contraceptives would reduce fertility (Stinson, *et al.*, 1982).

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[4]*Overviews of this research paradigm appear in Simmons, et al., 1987, op. cit and Phillips, et al., 1984 and 1985, op. cit. Efforts to develop this paradigm in the Extension Project have encountered considerable difficulties. Rather than review these lapses, which are uninformative in this context, an overview of the design and a synopsis of elements that worked are presented. For a discussion of the limitations of the organization development approach in constrained institutional environments, see Koblinsky, et al., 1987a and 1987b; Yunus, et al., 1984.*

Although services failed to affect fertility (Rahman, *et al.*, 1980), the CDP experience guided the design of the second Matlab project.

Thus, to understand why the Matlab Project succeeded, it is important to understand why the earlier experiment failed. Owing to its emphasis on contraceptive technology, the CDP design minimized the role of the supply side.

Social research for developing the service delivery strategy was minimal, so that the organizational structure, staffing pattern, training programme, service regimen, information systems and supervisory system were based on imported ideas of what would succeed rather than diagnoses of what works in the Bangladesh social context. As an inappropriate supply system, services generated controversy rather than behavioural change.

Use prevalence initially increased, lending support to the notion that demand was present, but prevalence soon declined, and returned to pre-project levels within 24 months, suggesting that the CDP system of supply could not sustain lasting behavioural change.

The demographic failure of CDP demonstrated that "supply" is not simply the provision of pills; instead, it concerns the complex science of interfacing service systems with social systems.[5]

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1. 2. Matlab Project design

In the Matlab project experiment, special services were introduced in 70 villages with a baseline population of 89,350 and demographic dynamics were monitored in a neighbouring 79-village comparison area with a baseline population of 85,596.

In the comparison area, usual government services were provided, and social, economic, and demographic conditions were otherwise comparable to those in the treatment area villages. Since October 1977, all currently married women in the treatment area have been visited twice a month, consulted about their contraceptive needs and provided with contraceptive care.

Basic health problems are addressed by maternal and child health (MCH) outreach, and referral services are available at nearby clinics. In the initial project period, health care was family planning support oriented, but with time the service regimen has been expanded to incorporate increasingly comprehensive services for the priority problems of mothers and children (Bhatia, *et al.*, 1980; Rahman, 1986).

By 1978, evidence of demographic impact was apparent, and by 1981 the effects were substantial.

Modern contraceptive prevalence rose from 5 to 35 per cent and fertility declined by 25 per cent. The fact that observed changes occurred in treatment areas only and areal fertility differentials commenced nine months from the onset of project services strongly suggests that the fertility decline in treatment areas was caused by the experimental services regimen in that locality.

Explanations of the surprising impact of the project focus on its successful strategy of adapting the service-delivery strategy to social conditions in rural Bangladesh, a process that has been referred to as the "sociology of supply." Four elements of the design collectively comprise the sociology of supply in Matlab (Simmons, *et al.*, 1987; Phillips, *et al.*, 1986).

Client-oriented services. Particularly critical to the success of the Matlab experiment is the role of young, married and literate village women as primary service providers.

As community health workers, they are responsible for visiting all women in their village twice a month, discussing

[5] *Rahman, et al., 1980; op. cit. review lessons from the Matlab CDP and the contribution of CDP to subsequent project design is in Phillips, et al., 1986. Simmons, et al., 1987 review the implications of the Matlab project for the sociology of supply. See also the review of the determinants of the impact of the Matlab project in Phillips, et al., 1982 and 1987.*

contraceptive preferences, providing methods and referring women to nearby clinics for basic health or family planning service.

Each village has one such female worker, 20 of whom comprise a team assigned to a cluster of villages termed a "union," where a clinic is staffed by a resident female paramedic. One male supervisor is assigned to a union to provide overall administrative support for operations.

The Matlab system attempts to confer special status on the female village workers, building upon what is known about the origins of social status in Bengal, and its importance in all aspects of village life. Female workers were hired from influential families in the villages where they lived and worked.

Although high social status contributes to their credibility as family planning workers, their youth and relative wealth are inconsistent with the extra-familial activities required by their job. Because village workers are women who are in purdah or seclusion and restricted to their hamlet, supervisory support is addressed to enhancing their status as health referral workers and community liaison personnel. Work areas are delineated by socially acceptable boundaries, strategy that minimizes social opposition to routine household visitation.

Given basic training in household communication and service techniques, and field support from supervisors, female workers can interact effectively with their village clientele.

Supervision, thus, aims to support female village workers in the execution of the socially-challenging task of introducing reproductive behavioural change where such change would not spontaneously occur.

The Matlab project outreach strategy was guided by CDP findings which showed that service credibility derives from providing a wide range of contraceptive options and basic health care services in a manner that permits women encountering problems readily to switch methods or receive counselling and care from household workers. The complex method regimen, in turn, requires staff competence in the delivery of multiple methods, and readily available health referral services.

The continuous regimen of field visitation, together with the complex service regimen, has demonstrated that, by building rapport and understanding, providing support for fertility regulation behaviour and offering contraceptive supplies to women in their homes, services can influence contraceptive use dynamics.

Internal cohesion

Social institutions in rural Bangladesh are not conducive to the formation of peer networks among unrelated women. A woman facing problems with contraceptive practice has neither familial support nor an extra-familial peer network to support contraceptive practice.

Similarly, a worker facing problems in her job has no natural social network supporting their resolution. Simple but effective support systems have been developed in Matlab to build internal cohesion in the work force, so that a worker is not alone in efforts to confront task-related difficulties.

A system of information collection, compilation and exchange is used in conjunction with frequent and regular staff meetings to foster peer support among project staff. Workers meet twice a month in a local clinic with paramedics and supervisors jointly to review progress, problems and future activities.

The Matlab worker support system is hierarchical, as well as lateral, with gender roles delineated in culturally acceptable ways that nevertheless confer upon women an unusual degree of authority.

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Two lines of support form a dual leadership system, i.e. one is clinical and female-operated and the other is administrative and male-directed. Taken together, these lines of support comprise a network of relationships designed to substitute strong system support for the social support that reproductive behavioural change would otherwise require.

Critical to achieving cohesion is designating appropriate gender roles for project supervisory staff. Thus, female paramedical supervisors, residing in nearby clinics, provide clinical support for the village service workers and conduct household visits on request. Male supervisors liaise with village leaders; they support women's contraceptive preferences in discussions with husbands and confer with religious leaders as needed.

Task accountability. Mechanisms for achieving accountability include an information system which records reproductive histories about each woman in a village, and routine reports provide supervisors with information about the pace of work, the content of services and the problems encountered. Workers can readily ascertain their own performance from the service registers, set rational goals, solve problems and place demands on supervisors to help solve them. Supervisors, in turn, can discipline or replace workers who fail to perform their duties.

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Community relations. Bangladesh rural society is often characterized as diffused, lacking structure and rife with conflict (Hartman & Boyce, 1983). A common theme in the literature on the family planning programme is the "need for community participation": In the Bangladesh context, however, the uncritical application of this axiom can inflict the consequences of social diffuseness on the programme rather than engendering the support of traditional village government.

Therefore, organizing services must accommodate conflicting operational needs — the need to be detached from village factionalism, yet linked to the elite. In general, activities that require sustained and continuous organization or resources are provided by the project with minimal reliance on community organization.

Nonetheless, intermittent and ad hoc community contributions to project functioning have been substantial. For example, each union served by the project was requested to donate facilities for clinics, in exchange for assurances of project-provided paramedical services, drugs and maintenance. Contributions engender a spirit of community collaboration even when operations are administratively autonomous.

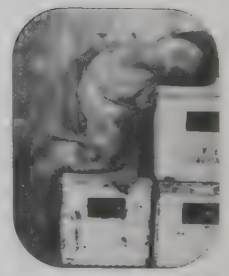
In sum, findings demonstrate that an appropriate system of supply, with structures and functions that are adapted to client needs and consistent with village institutions, can affect reproductive behaviour, even in the absence of social conditions that independently induce a demographic change.

Matlab, thus, represents a service model with potentially important implications for Bangladesh policy.

Although the replicability of the operational design may be questioned, the fact remains that the project worked — a conclusion supported by demographic data of unequivocal quality.[6]

The success of the project has, thus, shifted the focus of research to the supply side: since demand exists that can be met with services, the new challenge is to identify what is transferable, to institute operational change and to sustain bureaucratic transition in the national programme to a new operational design.

[6] Research has shown, for example, that the probability of use is a function of the distance to workers' homes. Distance, in turn, influences the contact rate, and contact affects the odds of contraception and the choices that are made. In this way, modelling of data shows the relationship between service dynamics and contraceptive use dynamics (Phillips, et al., 1986). See also qualitative research on the client relations issue in Simmons, et al., 1984, 1986 and 1987.



The Matlab experience also has international policy implications. Apart from the central finding that services could succeed, the paradigm represented by Matlab is broadly relevant to policy. However, the specific elements of the design are not necessarily exportable, since the sociology of supply necessarily differs from setting to setting.

Nevertheless, the principles of informed system development, of diagnosing institutional constraints and tailoring services accordingly, is broadly relevant to programmes elsewhere, particularly where the demand for contraception is fragile, and the need for rigorous systems of supply are correspondingly acute.

2. POLICY RESPONSE TO THE MATLAB PROJECT

Given the questions that have been raised about the demographic relevance of family planning services in rural Bangladesh, it seems that the unequivocal findings from Matlab would have immediate policy effects.

By 1981, however, none of the findings from Matlab was under active review by the Government of Bangladesh and operational implications were widely dismissed by senior officials as irrelevant to policy.

Several reasons for these reservations were apparent in the course of discussions:

1) The question that the project was designed to answer was addressed to international concerns about the efficacy of family planning services in a rural, traditional society. Confirmation of impact was reassuring but not indicative of a need for change in the national programme. Rather, the design of the programme appeared to be fundamentally sound.

2) Since the special resources of the Matlab project were not replicable, the Project's operational design was considered irrelevant to policy. Features of the Matlab system that were obviously not replicable, such as the availability of speedboats for supervisory work, detracted from the broader policy lessons that investigators sought to convey.

3) Although the operational design of the Matlab project was accepted as a model of what works in Bangladesh society, it was not accepted as a model of what works in the national bureaucracy. For example, changing the staff composition according to the Matlab model was not feasible; for - even if resources could be found to hire more women - it is not possible to fire men.

Thus, the project was viewed by Bangladesh government officials as probably irrelevant to their programme *because the additional resources, highly-trained staff, a sophisticated supervisory system, the organizational structure and other aspects of the project were thought to be non-replicable on a national scale.*

3. THE EXTENSION PROJECT: A SYSTEMIC INTERVENTION

The Matlab 1981 annual report documented for the first time the demographic impact of the experiment and the operational design that led to its dramatic effects. In response to reservations about the policy relevance of the project, the Bangladesh Planning Commission made resolution of the replicability question a condition for government concurrence with further external funding.

ICDDR,B was requested to expand Matlab activities to other areas of the country, but to use Government resources, mechanisms and procedures to the fullest extent possible. This new project was to be collaborative, with research direction provided by ICDDR,B and operational direction provided by the usual government administrative system.

Simply replicating the Matlab experiment would have incurred serious risks: a test of overly ambitious change in the public-

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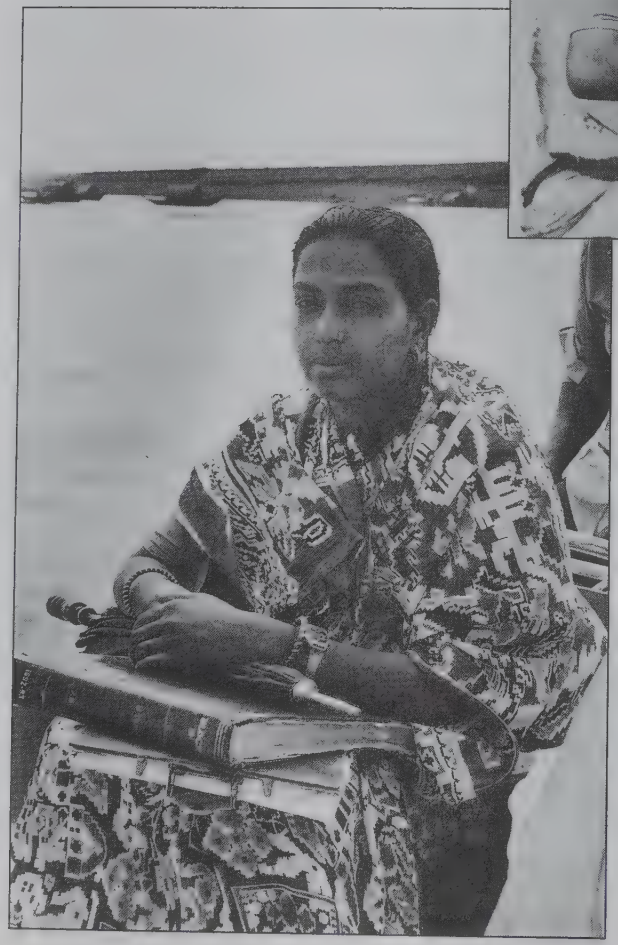
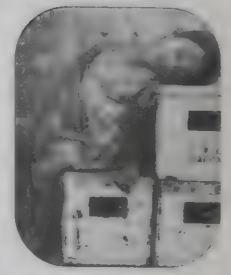
▲ *Healthy children born from healthy mothers. Bangladesh has no other alternative than to reduce its population growth.*



◀ *Is the model of the Matlab community health worker exportable to the rest of the country? The MCH-FP Extension Project attempts to provide answers.*



sector programme would lead to operational failure and official rejection of the policy implications of Matlab.

Launched in 1982, the Maternal and Child Health and Family Planning (MCH/FP) Extension Project is, thus, substantially different in its design and objectives from the Matlab experiment.

Rather than simply test whether the Matlab system would work if extended to the public sector, the Extension Project identifies the specific barriers to transfer and how those barriers can be removed through sustained organisational change.

As an experiment focused on the supply side, it does not aim to ascertain whether demand exists, but rather to determine whether existing demand can be activated with the appropriate system of supply in the public-sector programme.

The design has two basic components: **a research strategy** to assess, through a variety of instruments, the efficacy of the existing MCH/FP programme; its resource, technical and structural constraints; the operational change introduced by interventions; and the impact of the interventions on MCH/FP programme effectiveness; and **an intervention strategy** in which ICDDR,B staff use organization-building and training to transfer elements of the Matlab project to the public sector MCH/FP programme.

3. 1. Research strategy

The Extension Project resembles a paradigm, referred to in the organization research literature as *"organization development."* In this approach, research is typically initiated by senior management who invite consultants to assist their organization in identifying operational problems and improving organizational functioning. Social science research is used to identify problems and worker focus-groups are constituted to identify solutions, test alternatives and provide feedback on results to programme managers.

The idea of the approach is not so much to focus the attention of managers on the problems of a small segment of the organization, so that the problems there can be readily diagnosed and dealt with without major prior commitments to structural change, but to represent all levels of the organizational hierarchy in the design so that the system is the subject of analysis and collaborative problem-solving. In this way work cannot be dismissed as relevant only to a particular issue, unit or locality.

Joint "ownership" of research and decision-making is cultivated to foster use of results.

Typically, change agents are affiliated with the consultant organization and have no formal authority in the host agency. They facilitate change through counterpart support and close liaison with implementation committees (Phillips, *et al.*, 1982).

While the available research literature informed the design, much of what was tried departed from conventional notions of the organizational development paradigm (French & Bell, 1978), since much of what has succeeded elsewhere is obviously inappropriate for Bangladesh.

Developing a consensus among senior officials that change was needed and developing research strategies that could contribute to the planning process were major components of project activities.

Although the organization-development approach assumes that change agents are competent organization researchers, ICDDR,B's expertise derives more from its experience as a biomedical research centre with excellent field epidemiological skills than as an organization skilled in operations research.

It was, thus, necessary to develop organization research capabilities within ICDDR,B as the project was launched. Although some of the usual features of the organization development paradigm were missing, the Extension Project

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experience may be relevant to situations where bureaucratic functioning is rarely the subject of systematic review.

The initial ICDDR,B response to the order creating the Extension Project was to resist and subsequently to accommodate the government with token activity that would contribute little to scientific knowledge. Largely in response to donor pressure, ICDDR,B ultimately agreed to undertake a serious scientific investigation of the replicability of Matlab.

The Extension Project, thus, arose out of a series of negotiations relating to the preservation of Matlab rather than a commitment to engage in organization development activities. As a project with a formidable research and implementation agenda but a weak institutional footing, the Matlab operational model was critical to the implementation of the Extension Project.

As a motivating model, the Matlab success became the basis for exchanges and negotiations at all stages in the course of the implementation of the Extension Project.

Although a review of operations does not usually arise in bureaucratic systems, the obvious contrasts between Matlab and the government system made it possible for the project to stimulate discussions at various levels about what could be changed, given the constraints of the government system, and how to proceed with the institution of operational improvements.

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3. 1. 1. The experimental design.

Research is conducted in the MCH/FP Extension Project within the framework of an experimental design. Panel data from a representative sample of the population monitor the intensity of service outreach and the adoption of the health and contraceptive practices.

The systematic study of the government programme and the manner in which it changes during the experimental interventions functions together with other components of the research system to form a unified approach in which each component compliments other parts of the research system. Each component is reviewed in turn.

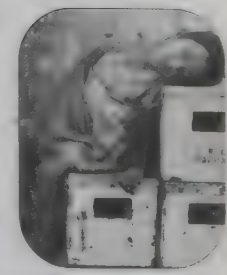
The treatment design has three cells, each with sample demographic surveillance data about fertility, mortality or morbidity and contraceptive practice. Unlike Matlab, where cells measure the impact of interventions, in the Extension Project two cells have the same interventions, but contrasting processes of introducing change in the public-sector system. The design is, thus, "process-oriented," with the aim of generating variance in the way the system is changed so that barriers to the transfer of Matlab strategies are elucidated.

The two treatment cells vary the intensity of ICDDR,B field involvement in the transfer process - a "counterpart-support" cell tests whether change can be introduced by ICDDR,B field staff working with the staff of the Ministry for 90 days of joint implementation of work routines, and a "training only" cell tests whether technical training alone is sufficient to introduce change.

The third cell, located in contiguous areas external to experimental districts, has a research-only focus, and permits evaluation of treatment area impact.

To avoid the limitations of generating a special administrative zone that becomes atypical of the larger system, two subdistricts in different geographical areas were identified for the study, each with a full range of treatment, interventions and research activities. Within these areas, nine treatment unions were randomly chosen; in contiguous subdistricts, four comparison unions were chosen.

Longitudinal observation of households: The analysis of the Project's impact is achieved through a longitudinal household-based data system that provides information on social, economic



and demographic characteristics of households and the individuals within them; on vital events including fertility and mortality; on service-delivery interventions including family planning and maternal/child health interventions; on contraceptive use; and on use of health services by household members.

The principal use of this system has been to study the relationship between project interventions and the quantity of household visitation, and the relationship between visitation and the dynamics of contraceptive use (Koblinsky, *et al.*, 1987b; Phillips, *et al.*, 1986).

Organizational analysis:

Based on the premise that human service programmes are shaped by the larger social, economic, political, cultural and bureaucratic forces in society, the organizational systems analysis investigates the "interconnectedness" and mutual causality of programme elements and the larger context within which they function.

Particular emphasis has been addressed to questions about the nature, quantity and quality of the exchanges that take place between service providers and clientele. This critical interface represents the proximate operational determinant of reproductive behaviour, and observation of motivational strategies, client-worker relationships (extent of rapport, trust, hostility, conflict) and worker-community relations are key indicators of service quality and performance.

The public-sector system is also the focus of analysis. Resources, legitimacy and support for its activities in the larger environment are analyzed, as well as systems-support capabilities (logistics, personnel systems and mechanisms for establishing supervisory, community and policy support).

The sociology of work is the subject of observation: decision-making, conflicts, peer support and leadership. Lines of communication and authority are studied to ascertain ways in which information can be collected, compiled and used to develop cohesion.

The afore-mentioned organizational diagnostic activities guide the development of the Extension Project intervention strategy. Panel data are collected to analyze the process of change in the Ministry system and to permit rigorous statistical analyses.

More important, however, is the role of research in the implementation strategy. Lessons learned regarding the structure and functioning of the Ministry system are shared with project participants to stimulate change and organization development within project areas and to foster change in the national delivery system.

3. 1. 2. The mixed research paradigm.

The Extension Project uses four types of research activities. Each has a unique contribution to the policy development process:

1) The Extension Project is undertaking activities initiated by senior government officials and implemented by subdistrict officers with project staff playing a facilitating and co-ordinating role;

2) Case studies, written by experienced Ministry officers at the district and subdistrict level, aim to stimulate high-level analysis of the programme based on practical field experience with implementation;

3) Technical studies are conducted on such issues as staff composition and density, the determinants of worker performance, the efficacy of clinical services and other operational issues. Such research aims to identify sources of problems and the prospects for improving programme performance; and

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4) Basic demographic research is conducted in the "controlled" environment of Matlab on broader policy and demographic issues, including the health and mortality impact of selected MCH interventions.

All four types of research have had policy impact:

the *first* because initiatives from the government are central to strategic planning;

the *second* because the insights of government field officers can provide a form of communication from the field to central authorities that is otherwise lacking;

the *third* because key operational issues not readily identified by administrators can be articulated and communicated to policy-makers; and

the *fourth* because assumptions that underlie general policy are often untested by systematic research.

Throughout this process social learning takes place, affecting researchers and administrators alike, and informing key policy-makers about the functioning of the Ministry's programme in a way that would not otherwise take place. These four types of research are used as basic tools in a coordinated programme to facilitate policy development and management improvement.

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3. 2. Intervention strategy

Project interventions are inseparable from the research design, and are designed to compliment the contribution of research to policy development. Four strategies are particularly noteworthy:

3. 2. 1. Collaborative problem-solving

As a mechanism for translating research into administrative action, "project implementation committees" were constituted to direct field activities and to provide feedback on results to senior programme managers.

In a successful intervention, these committees function as focus groups at each level of the organization to synthesize lessons and communicate research findings within the bureaucracy through established channels.

The idea of the approach is to focus the attention of managers on the problems of a small segment of the organization, so that dysfunctions there can be readily diagnosed and dealt with without major prior commitments to structural change.

By feeding research outcomes, deliberations and directives upwards and downwards, all levels of the organizational hierarchy are the subject of analysis and collaborative problem-solving.

ICDDR,B change agents attempt to facilitate change through participation in these committees in close liaison with workers at all levels. While ICDDR,B has no formal authority over the work system or the implementation of the project, its informal influence is extensive.

The critical, initial point of collaboration in the Project took place at the subdistrict level, the primary unit of organization of health services in rural Bangladesh.

Subdistricts typically have a population of about 300,000, an elected government council, an administrative headquarters with basic government facilities, including a health complex staffed by resident physicians and paramedics.

The health complex is a rural health facility that provides curative services and also functions as the major administrative level for rural health, MCH and family planning field activities.

A physician from the Health Division of the Ministry of Health and Family Planning, the subdistrict health administrator, is the

chief administrative officer at the health complex. He is supported by a staff of medical officers for clinical services, one medical officer for providing technical supervision of rural family planning and MCH services, and two administrators, one for the supervision of family planning and MCH, the other for health activities. Below the subdistrict are 10 to 12 "unions," each governed by an elected council. Roughly a third of the unions in Bangladesh have standing government clinics with a resident paramedic.

In the initial period of the project, joint planning and decision-making meetings involving ICDDR,B staff and subdistrict health officials were launched under a special government order constituting the project. The subdistrict health administrator, medical officer, family planning officer and health inspector were instructed in the original order to be the key field-level collaborators in the project.

By working with these officials, ICDDR,B field officers seek to strengthen field orientation, technical competence and planning capabilities at this mid-management level to ensure greater control and support capabilities for programme implementation in the villages.

3. 2. 2. The use of replicable resources

The process of transferring the Matlab operations to the government's system in areas under the Extension Project was deliberately constrained: special operational inputs were disallowed, staffing was provided by the government and patterns of supervision and supplies were unchanged. The areas retained their ministerial character so that the project would not take on a special quality that would dilute its relevance to policy.

The assumption underlying the project is that ICDDR,B has technical skills that can be transferred to the Ministry's system through training and counterpart support, without introducing incremental resources or major structural change.

The training programme focused on technical deficiencies, and counterpart support focused on transferring certain aspects of the Matlab field management system.

3. 2. 3. Maintaining a systemic focus

In keeping with the observation that systemic diagnosis is more likely to lead to sustained change than activities in a few localities or a series of small-scale ad hoc studies, the project aimed to develop a coordinated strategic plan over a sustained period of time, tested and refined in limited areas, but developed in collaboration with national authorities and donors, with a view towards wider implementation.

This process has yet to mature in Bangladesh, but efforts to develop the Extension Project are guided by this systems perspective.

3. 2. 4. Introducing the Project as a transfer of Matlab innovations

Initial efforts to establish project operations were unfocused, with government participation more characteristically being passive compliance with ICDDR,B requests than meaningful collaboration on field activities. In the early months of establishing collaborative mechanisms with the Matlab model, questions of transferability and prospects for testing strategies in the field provided a focus to discussions and concrete objectives to pursue.

Improving field activities in health and family planning and communicating mechanisms for change to senior officials was a long-term aim, but initial efforts focused on government primary service workers affiliated with the health and family planning divisions of the Ministry.

Male workers from the health division have traditionally been responsible for health education and the control of communicable

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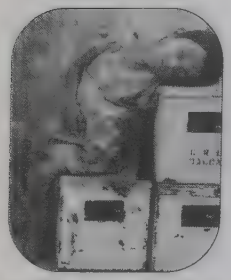

disease, while female field and paramedical staff, supervised by a male family planning worker, have been in charge of MCH and family planning work.

Key objectives of the Extension Project intervention strategy at this level were to remedy deficiencies in technical knowledge, to redirect field methods towards client-oriented approaches, and to introduce a more effective management control and support system. A series of training courses each four weeks long was organized for groups of 20 workers.

Three key components of the Matlab training programme were covered, namely, family planning, oral rehydration therapy, tetanus immunization and other health subjects assigned to these workers by government policy.

Priority was given to practical demonstration of field methods: household visiting patterns, motivational techniques, community relations, referral and record keeping.

Following a month of formal training, emphasis was placed on establishing the rudiments of the Matlab system in the field: calendar-based work routines in "door-step" family planning and MCH services, systematic follow-up, regular meetings for problem-solving, supervision and support. A simple household record book was introduced that permits workers to keep track of their clientele and monitor their own performance.

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Major change agents for this activity were Matlab community health workers and supervisors who had five years of experience in the Matlab system. They provided counterpart support to government field staff and their immediate supervisors as agents of planned change for a period of three months following training.

At the national level a formally constituted coordinating committee, consisting of senior officials from the Ministry and relevant research organizations, reviews findings from the subdistrict and field level. This committee receives reports from the subdistrict committees, reviews progress and assists in overcoming operational barriers to project implementation.

Through this process, the project aims to communicate operational problems, and ways of solving them, to key decision-makers who can subsequently use project findings for large-scale policy planning.

4. POLICY RESPONSE TO THE EXTENSION PROJECT

The Matlab and Extension projects have neither transformed population policies in Bangladesh nor radically redesigned the service programme.

What has been developed, however, is a new paradigm of research-informed planning, leading to significant changes in the staffing pattern, training system and management system that would not have occurred without the collaboration of ICDDR,B and the Ministry on the Extension Project.

As previously mentioned, key elements of the Matlab success are related to the Project's sociology of supply - its capacity to establish client-oriented services, internal cohesion in the work-force, task accountability and appropriate mechanisms of community relations.

Although the attempts to develop these elements in the government programme were associated with corresponding obstacles, considerable success has been realized by adapting each Matlab project strategy to the public-sector system rather than replication per se. Some examples of this adaptive process are as follows:

4. 1. Developing client-oriented services

In government service areas, three female village workers are

responsible for 20 villages — a work area assigned to 20 such workers in Matlab.

Where Matlab has one male worker in charge of a union, the government has four, and little structural clarity about how they relate to one another or to the female workers. Other aspects of the Matlab sociology of work are also missing in the public-sector programme, but none represents a more formidable constraint to transferring the Matlab experience than the shortage of female village workers.

From statistical studies, participant observation and other research, it was soon obvious that the Extension Project could not replicate Matlab, or even part of the Matlab system, until this fundamental problem of staff composition was resolved: In the absence of female service providers, the programme cannot reach women with services. No amount of training, staff development or management system improvement would overcome this fundamental problem.

It could be argued that this insight could arise from a variety of research sources — that something so complex as the Matlab and Extension projects is unnecessary for so basic a research finding. However, in the absence of the Extension Project, it is unlikely that the response to this finding would have been as comprehensive and systematic as has been the case with the contribution of the project to the Third Plan.

More than a statistical result, the finding generated reports, memoranda and minutes emanating from within the Ministry of Health and Family Planning, written about ministerial operations in partnership with ministry personnel. As a finding that was developed and owned by those who were using the result, the decision to change the staffing pattern was a natural outcome of research.

In a 1984 response to project findings, the Government of Bangladesh ordered an expansion of the female work force by 10,000 women. That decision, in turn, led to project-based field testing of the hiring process, which generated guidelines for the national hiring process. This, in turn, has led to revisions in personnel-hiring procedures, training, supervision and other aspects of the field operation that could not have been developed as piece-meal ad hoc outcomes of operations research.

For so extensive a change to occur, a systemic research design is required, a sequential development of policy in response to implementation experience in the Extension Project areas, and internal ministerial review of progress at critical stages in the implementation process.

4. 2. Developing internal cohesion

Staff cohesion and lines of authority are poorly developed in the government health and family planning system. Workers rarely meet to discuss work, set goals or solve problems. In the project areas, progress has been made in transferring the Matlab information system, establishing regular meetings and developing the rudiments of team-work. Visitation is more regular and intensive as a result and prevalence has increased.

The project has not yet had a corresponding impact on the work system at the national level, however, because changes in the management information system, supervisory training system and the pattern of work will require several years of effort and additional experience with scaling-up innovations developed to date.

4. 3. Developing task accountability

Worker accountability cannot be readily imposed in the public sector. Targets are routinely set, but rarely achieved. Schemes designed to motivate workers through incentives, sanctions, travel compensation and the like inevitably fail because support mechanisms are so weak that workers cannot successfully respond to "motivational gimmicks."

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Success soon creates a need for supplies when the supply system is unreliable, accumulates clients in need of paramedical support when clinics do not function, and generates users when capacities to follow up existing clientele are already over-stretched. The more a worker succeeds, the greater the need for supervisory support. Consequently, individual achievement strains work relationships.

Social and economic pressures on the work force exacerbate this operational malaise. Female worker familial roles require women to stay close to home, since domestic responsibilities persist when women are employed. Owing to the low pay in the public sector, male workers are increasingly pressed to pursue economic roles that compete with time available for their formal job.

Routine compliance with work regimens, thus, threaten a worker's welfare. While workers are neither lazy nor unproductive in the pursuit of family welfare, non-performance on the job is sometimes a necessity.

In response to these barriers to instituting accountability, the Extension Project, through training and counterpart support, attempted to adapt the Matlab system to the government system in the project areas. Work routines were defined, meetings were established, information systems were developed, supervisory field visits were imposed, and other aspects of the work system were improved.

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Matlab and the Bangladesh FP&H Programme

Matlab was the operational model, but its adaptation was the source of constant negotiation, trial, and tension. To the extent possible, problems, barriers and difficulties were communicated to central authorities and became a source of social learning at the policy level and operational change in project areas.

4. 4. Developing community relations

As an externally funded effort, resources for the Bangladesh population programme are centrally allocated, according to rigid rules and regulations that obviate the need for community resources or relations. The building of clinics is slow owing to procedural delays, and all implementation of clinical services lags as a consequence.

The Matlab system of staff interchange, paramedical support and community relations could not be replicated as a consequence of the absence of clinic facilities.

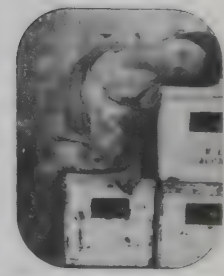
In response to field reports addressed to this issue, project committees were ordered to implement Matlab-like clinics, where facilities are donated by the community but continuing operations are provided by the project. After successful demonstration of this scheme in eight project unions, a national policy of implementation of community-donated facilities was promulgated during the Third Plan.

While this successful introduction of policy change represents a possible contribution to programme impact, key elements of the Matlab system of community relations are not yet developed in project areas, most notably the support system of male workers' liaison with the elite on work-related issues.

In sum, key revisions in national policy and implementation have been initiated and sustained in response to Extension Project activities. What has emerged is an operational model that is neither the Matlab system nor the Ministry's system, but something new and unique to project areas that must be scaled up into national operational planning.

Some 20 districts, comprising about a third of the country, are currently engaged in a programme-development exercise, with procedures that are informed by project experience.

Whether the national system of work is ultimately affected remains to be determined, but key objectives of the organizational



development exercise are consistent with project findings: staff density will be increased so that specified work routines become more realistic. Recruitment, training and posting procedures are to be developed along the lines of the Extension Project model. These changes, together with improvements in logistics and information systems, make it possible to improve the national climate of worker accountability on the Extension Project model.

Thus, the adaptation of the Matlab model to the public sector has produced a new model for services in project areas that differs from both the pre-project government system and the Matlab system.

Although this new model, when developed on a national scale, may not represent a systemic change of the sort attempted by the project paradigm, changes have been substantial and may ultimately improve the national system of contraceptive care.

5. CONCLUSION

This article has reviewed the design and accomplishments of two field research projects that are conceptually inter-linked and yet operationally distinct.

The Matlab project is a demographic success that had little practical impact on government policy until the Extension Project researched the policy-development process. Matlab nevertheless demonstrated that an appropriate system of supply can have a sustained impact on contraceptive behaviour and fertility trends in an unfavourable social, institutional and economic context.

The MCH/FP Extension Project has begun to demonstrate that systemic diagnosis of service-delivery problems and a continuous research programme tailored to the needs and interest of programme managers can lead to improved policy development and programme performance in an unfavourable bureaucratic context.

5. 1. Lessons from the research strategy

To date, four implications may be derived from the Matlab and Extension Project research experience:

Where programmes do not work, the development of an operational model is a necessity

An important practical outcome of the rigorous Matlab studies was that they established the scientific credibility of the Matlab system and ICDDR,B staff in the eyes of the Ministry and interested donors. This scientific credibility was an essential aspect of the Ministry's willingness to collaborate with ICDDR,B staff and of the donor agency's willingness to provide support for the research effort. The model that Matlab represents was crucial to establishing mechanisms for the diagnosis of barriers to implementing the national programme.

Demonstrating the demographic impact of pilot projects is not enough

Underlying operational issues and strategies must also be studied and understood. Simply demonstrating that something works has no policy impact, unless the operational implications of the successful strategy are clearly understood by key decision-makers. Careful study of project implementation and the processes by which policies and implementation strategies change and develop should, therefore, be incorporated in programme-research designs. This emphasis on process research, in addition to demographic-impact research, is a critical distinction between the Extension Project design and the Matlab Project on which it is based.

Research project decision-making should be collaborative at all levels

Only when the management approaches used in Matlab were tested by the Ministry of Health and Family Planning using its

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Matlab and the Bangladesh FP&H Programme

own workers (within government resource constraints) were operational lessons from the field readily discussed and reviewed for their national implications. Only then did Matlab receive the careful scrutiny from policy-makers that it deserved.

This process of transferring "ownership" of the Extension Project from an outside research institution to the Ministry was facilitated by the establishment of committees of researchers and programme managers at each organizational level to collaborate in setting objectives, diagnosing problems, developing plans and reviewing policy and management implications of study findings.

Programme research thereby becomes a management tool undertaken in response to the needs of policy development and management improvement, rather than a series of ad hoc activities.

Research and intervention should follow a systemic design

Programme operations and management cannot be isolated from the organizational and societal contexts in which they occur. Hence a systemic approach to problem identification and problem-solving is necessary.

In this approach, research addresses the broader context of operational problems and the inter-connected barriers to improving performance. Proposed changes anticipate the complexity of bureaucratic malaise and the need to intervene on a range of issues that interact to impede programme success.

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Matlab and the Bangladesh FP&H Programme

5. 2 Lessons from the operational design

What has been learned from the Matlab and Extension Project intervention strategies that could inform policy development elsewhere? It should be noted that no generalized package of service approaches has been identified, or ever will be identified, that will work everywhere.

What has succeeded in Bangladesh merits consideration, testing and development elsewhere, but specific operational approaches developed in one setting, to succeed elsewhere, must be adapted and modified for the host environment.

Nonetheless, it may be argued that the paradigm for policy development which the Bangladesh projects represent is broadly relevant to other settings, even if the specific elements of the operational design are not. Four phases in this process are critical to informed programme development:

Where demand for contraception is fragile, programmatic research must be grounded in careful social research, diagnosing constraints to demand for contraception

It is unlikely that any configuration of interventions will succeed unless strategies are informed by a thorough understanding of the societal constraints to fertility change and adapted to those institutional realities. One could argue that the search for appropriate interventions in Matlab, represented by the CDP two-year trial-by-error approach, would have been more efficiently pursued by micro-studies, focus-group review of proposed operations or other established social research methods for identifying socially promising operational strategies.

Nonetheless, while the research techniques to be used and the operational outcomes proposed will differ from setting to setting, the role of diagnosis in the design of the sociology of supply will be particularly crucial to success wherever supply-oriented strategies are pursued in settings where the demand for contraception is weak.

Pilot testing of the system of interventions is critical to the successful development of policy in settings where no known operational model for success exists

In settings, such as Bangladesh, no amount of social diagnostic research will definitively answer the question of what works, or

obviate the need for rigorous controlled trials of the Matlab variety. Field experiments not only test hypotheses, they also develop a credible operational model for success that can inform the development of policy.

As Matlab illustrates, pilot success can demonstrate a vastly more appropriate operational design than the established public sector programme. To facilitate the process of developing the most sociologically-appropriate operational design possible, pilot projects should be developed in a bureaucratic vacuum, isolated from existing programmes, and structured to address social rather than public-sector bureaucratic constraints.

Bureaucratic systems diagnosis and experimental change is crucial to the use of pilot projects

With the development of an operational model that works, given the climate of demand for services, the new challenge is developing a model for organizational change that will work, given the established public-sector system of supply.

It may be argued that policy research must address the problem that the appropriate operational model may differ from existing designs, and that public bureaucracies have rules, structures and traditions that resist change.

Just as the search for selected service interventions must be informed by an understanding of the cultural setting, the search for feasible operational alternatives must be informed by an understanding of the bureaucratic culture. This search is appropriately pursued in a systemic research design, employing a variety of instruments and methods, with a transfer experiment of the Extension Project variety at its core. Extension represents a vital intermediate step that can bridge the gap between a small-scale pilot project and large-scale operations in the effort to translate research into policy.

Mechanisms for scaling up operations should be incorporated into experimental designs

The use of results was a natural outcome of the findings, and the decision-making system that the Extension Project represents. Moreover, the promulgation of policy is not the end product of the paradigm.

Decisions to use research at each stage have generated new questions about what will work, how to develop policy further and how to guide the implementation process.

Project staff, formerly confined to two subdistricts, are currently working throughout Bangladesh to monitor implementation and to assist senior officials with linking problems in the larger system back to the decision-making resources in the more controlled and administratively digestible environment of the Extension Project.

In sum, the Bangladesh studies are potentially instructive to policy development efforts elsewhere. In contrast to the Matlab Project, which was launched to determine whether services could succeed despite societal constraints to contraceptive practice, the Extension Project was launched to determine if organization development in the public sector is possible despite bureaucratic constraints to operational change.

Just as the Matlab Project has shown that reproductive change can be induced with the appropriate sociology of supply, the Extension Project has shown that a system for research and decision-making pilot projects can induce organizational change even in bureaucratic contexts that are not conducive to sustained organizational development.

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It's easy to make Matlab children smile, now that they are born healthier, lead healthier lives and have fewer siblings with whom to share their food and clothes. Even the more conservative elders have grudgingly accepted the concept of planned families.

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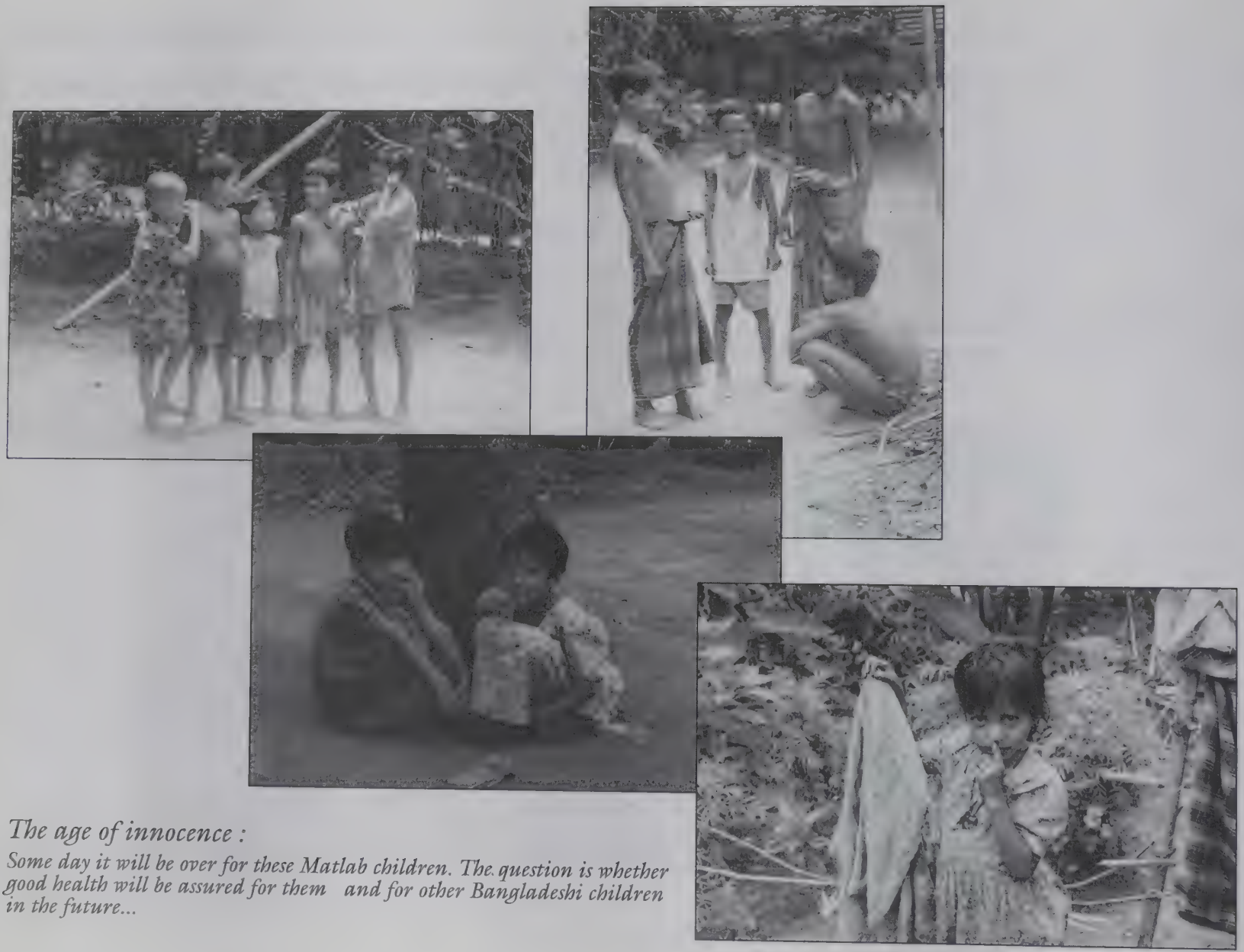


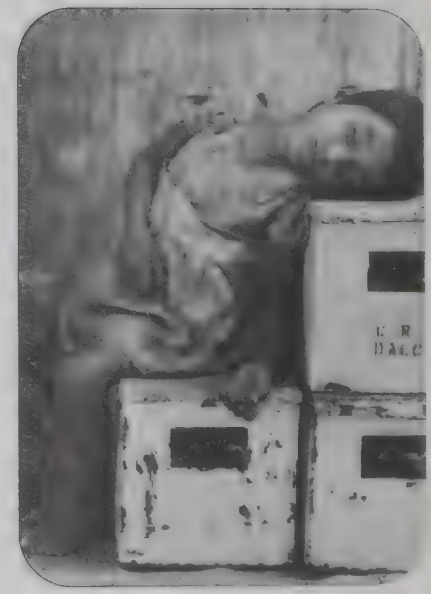
The age of innocence :

Some day it will be over for these Matlab children. The question is whether good health will be assured for them and for other Bangladeshi children in the future...

CHAPTER 23

CONCLUSIONS: What Has Been Learned in Matlab?

Vincent Fauveau



At the end of this review of lessons learned in Matlab between 1975 and 1990, one must ask a few crucial questions:

First, what has Matlab demonstrated? Second, has Matlab contributed to the progress of the Bangladesh Government Family Planning and Health Programme? If yes, in which specific areas has Matlab contributed? And, conversely, in which areas has Matlab failed to contribute?

The answers to these questions are *not easy to state*. The role of Matlab has not been perceived in the same way by the various researchers and programme heads who have worked in Matlab. Some have used Matlab to test their own hypotheses regardless of the relevance to the country situation, while others have derived their research hypotheses from the analysis of the prevalent epidemiological, socio-cultural, and programmatic conditions.

Some have given priority to the needs of the community and implemented health services at the risk of modifying the scientific conditions (comparability of areas). Others have given priority to science and tried to restrict the provision of services to evaluate the effect of interventions incrementally over a much longer period of time. With the sequence of successive researchers and programme heads, the approach has not been consistent. Only the field teams, headed by their manager, have consistently tried to maintain continuity in the improvement of services for the Matlab community, to reduce the high mortality and morbidity prevailing in rural Bangladesh.

1. WHAT HAS MATLAB DEMONSTRATED?

A central issue for Matlab is that of evaluation: What has been achieved in Matlab during the period considered? Is it possible to measure these achievements?

TABLE 1

Some specific health and family planning interventions in Matlab and their evaluation (published, unpublished, or not done)

Intervention and area involved	Date of start	Evaluation on	Discussed in Chapter	Authors and year of publication
Family planning (4 blocks)	Nov 1977	Fertility	6	Phillips, *et al.*(1982)
		Infant mortality	6	Chen, *et al.*(1983)
		Adult female mortality	6	Fauveau, *et al.*(1988)
		Child mortality	12	Briend, *et al.*(in press)
		Maternal mortality	6	Koenig, *et al.*(1988)
TT immunization of pregnant women (4 blocks)	Jun 1978	Neonatal mortality	8	Rahman, *et al.*(1982) Chen, *et al.*(1983)
ORS packets distribution through *bari* mothers (4 blocks)	Jan 1979	Mortality due to diarrhoea		Shaikh, *et al.*(1990)
		Child mortality	9	Fauveau, *et al.*(1992) Chen, *et al.*(1983)
TT immunization of all married women (2 blocks, A + C)	Jan 1982	Unpublished	8	
TT immunization of all married women (4 blocks)	Jan 1986	Unpublished	8	
Measles vaccination (2 blocks, A + C)	Mar 1982	Child mortality	11	Clemens, *et al.*(1988) Koenig, *et al.*(1990)
Measles vaccination (4 blocks)	Nov 1985	Unpublished	11	
Other EPI vaccines DPT, polio, BCG (4 blocks)	Apr 1986	Not evaluated		
Safe-delivery kits, Antenatal risk screening, Iron-folic acid tablets, and nutritional advice, during pregnancy/postpartum (2 blocks, A + C)	Oct 1982	Not evaluated	7	
Same in 4 blocks	Jan 1986	Not evaluated		
Nutrition Rehabilitation in central Matlab clinic	May 1986	Not evaluated	12	
+ nutrition education (4 blocks)	Jan 1987	Not evaluated	12	
Nutrition Rehabilitation (at subcentres in 4 blocks)	Sept 1988	Not evaluated	12	
Vitamin A capsules distrib. (4 blocks + comparison area)	Aug 1986	Unpublished	12	
Maternity care (midwives + referral) (2 blocks, C + D)	Mar 1987	Direct Obstetric Mortality	7	Fauveau, *et al.*(1991)
Field management of ALRI (4 blocks)	Jan 1988	Mortality due to ALRI	10	Fauveau, *et al.*(1992)
Field management of dysentery (2 blocks, A + B)	May 1989	Unpublished	9	

There are several ways of evaluating such a large project over such a long period of time.

According to the evaluators' standpoints, there can be a **demographic** evaluation (trends of fertility and mortality), a **socio-cultural** evaluation (evolution of attitudes and behaviour regarding health), an **epidemiological** evaluation (changes in the incidence, prevalence, case-fatality, cause-specific mortality of diseases), a **programmatic** evaluation (trends of the number and quality of services delivered), or an **economic** evaluation (analysis of costs and output of the project).

Elements pertaining to each of these types of evaluation are found in the chapters of this book, and it is not possible to discuss all of them again here. For some of these types of evaluation it was difficult or impossible to find proper indicators; for other types the indicators have not been collected in a consistent manner, while for others there was no baseline information with which to compare.

The indicators that have been the most frequently and regularly measured in Matlab throughout the period considered were **contraceptive use and attitudes toward fertility control** (discussed in Chapters 6 and 15), **mortality levels and trends** (discussed in Chapters 3, 7, 8), **fertility trends** (discussed in Chapter 7), **vaccine coverage** (discussed in Chapters 8 and 11), and **the number of ORS packets distributed.**

Among these indicators, the most frequently used were mortality indicators, either by comparing mortality levels between different areas or between different periods of time, or by analyzing trends over long periods of time. Concerns have been expressed about the use of mortality as an indicator to evaluate health interventions, for several reasons:

i) measurement of changes in mortality requires large populations, long surveillance periods, and high costs;

ii) it is often difficult to establish a direct causal relationship between the observed mortality changes and the intervention;

iii) the mortality impact of an integrated health project is not the sum of the mortality effects of its individual components;

iv) the effect on overall mortality of an intervention aimed at reducing mortality from a specific disease may prove to be either multiplicative, or substitutive, or neutral;

v) mortality is just one component of the evaluation, ignoring morbidity indicators, process indicators, socio-cultural changes, and cost-effectiveness analysis.

However, Matlab is one of the few places in the world where the use of mortality to evaluate health programmes is justified, because:

i) the Matlab demographic surveillance system provides reliable, complete, and detailed counts of vital events consistently over a long period of time and in a large population (see Chapter 4);

ii) the demographic surveillance system is independent of the health service programme;

iii) a recently improved method to assess causes of death (see Chapter 5) allows the establishment of cause-specific mortality for some key diseases with reasonable confidence;

iv) the size of the project allows mortality rates to be broken into age-, sex-, and cause-specific rates, thus allowing targeted evaluations in addition to overall time trends; and

CONTINUED...

v) almost all interventions implemented in Matlab were designed to be evaluated against control populations.

With these methodological considerations in mind, the effect on mortality of some specific health and family planning interventions implemented in the Matlab project has been evaluated by several researchers in the last decade.

The interventions are summarized in Table 1 (facing page), and those for which an evaluation has been attempted are indicated.

It appears that a number of interventions have not been evaluated, and this was because of either flaws in the design of the implementation, or a lack of appropriate indicators or, in some cases, unexpected changes in investigators' plans.

A wide range of methods have been used for evaluating the effect of interventions: examination of mortality trends over time, area comparisons in a given period, area comparisons combined with period comparisons, retrospective case-control approaches, and longitudinal life-tables.

In addition to the studies mentioned in Table 1 which evaluated some specific health and family planning interventions, a few other studies have attempted to evaluate the overall effect of "packages" of interventions on infant and child mortality (Chen, *et al.*, 1981; Chen, *et al.*, 1983), on neonatal and post-neonatal mortality (Bhatia, 1989), on infant, child and adult female mortality (Fauveau, *et al.*, 1990), and on fertility (Phillips, *et al.*, 1982).

The Matlab demographic surveillance system also provides the data to construct graphs illustrating trends over time concerning specific indicators in the Matlab MCH-FP and comparison areas between 1975 and 1990:

CONTINUED...

Conclusions

- ☐ The trends of ***crude birth and death rates*** are found in Figure 6 of Chapter 3 *(Page 42)*, taken from Menken & Phillips, 1990), while the trends of crude birth rates are also found in Figure 2 of Chapter 6 *(Page 97)*.

- ☐ The trends of ***child mortality rates*** are found in Figure 4 of Chapter 11 *(Page 216)* and in Figure 3 of Chapter 12 *(Page 249)*. This trend was affected by the outbreak of dysenteric diarrhoea in 1983-84, responsible for a peak in mortality in both areas.

- ☐ The trends of ***neonatal mortality rates*** are found in Figure 1 of Chapter 8 *(Page 143)*. It is evident that the difference between areas started to be significant and consistent after the introduction of tetanus toxoid immunization of pregnant women in 1978. Recently, since 1989, the difference has been reduced, and this is probably an effect of the development of the immunization programme in the comparison area.

- ☐ The trends of ***infant mortality rates*** are found in Figure 3 of Chapter 15 (using an unconventional rate of infant deaths per 1,000 population, *(Page 295)*, using the conventional rate of infant deaths per 1,000 live-births. The peak in infant mortality observed in both areas in 1975 is due to the famine. Since then, infant mortality has followed similar patterns in both areas, with a consistently lower rate in the MCH-FP area.

  Infant mortality being largely influenced by neonatal mortality, which is, in turn, largely influenced by neonatal tetanus, it is conceivable that the recent decline in infant mortality in the comparison area is at least partially explained by the drop in neonatal tetanus mortality discussed above.

- ☐ The trends of ***maternal mortality*** (expressed either as rates of maternal deaths per 10,000 women, or as ratio of maternal deaths per 1,000 live-births) are found in Figure 2 of Chapter 7 *(Page 122)*. As discussed in the same chapter, the maternal mortality rates have been consistently lower in the MCH-FP area than in the comparison area, but this was not the case for maternal mortality ratios.

- ☐ The trends of ***total fertility rates*** are found in Figure 3 of Chapter 6 *(Page 98)*. The difference between areas has been consistently marked since 1978, and there does not seem to have been a decrease in the difference in recent years.

Broadening the scope of achievements in Matlab, it is interesting to compare a few demographic and health indicators in the Matlab intervention area with the goals set up by the Bangladesh Fourth Five-Year Plan (1990-1995), to be achieved by the years 1995-1996 (Table 2, below).

For almost all indicators, the goals set for the whole country in 1995 have already been attained or passed in the Matlab project area. With the notable exception of the crude death rate, none of these goals had been reached in the neighbouring Matlab comparison area in 1989-90. As discussed in Chapter 15, the reason for these achievements does not lie in any specially favourable conditions found in the Matlab project area, but rather in the difference in intensity of the maternal and child health and family planning service programmes between the two areas.

2. WHAT HAS MATLAB CONTRIBUTED TO THE PROGRESS OF THE BANGLADESH FAMILY PLANNING AND HEALTH PROGRAMME?

The focus of this review being the lessons learned which have a potential relevance to Bangladesh, an attempt should be made to summarize these lessons. There are positive and negative lessons which can be classified into four categories:

1) areas in which the Matlab experience has provided clear

TABLE 2

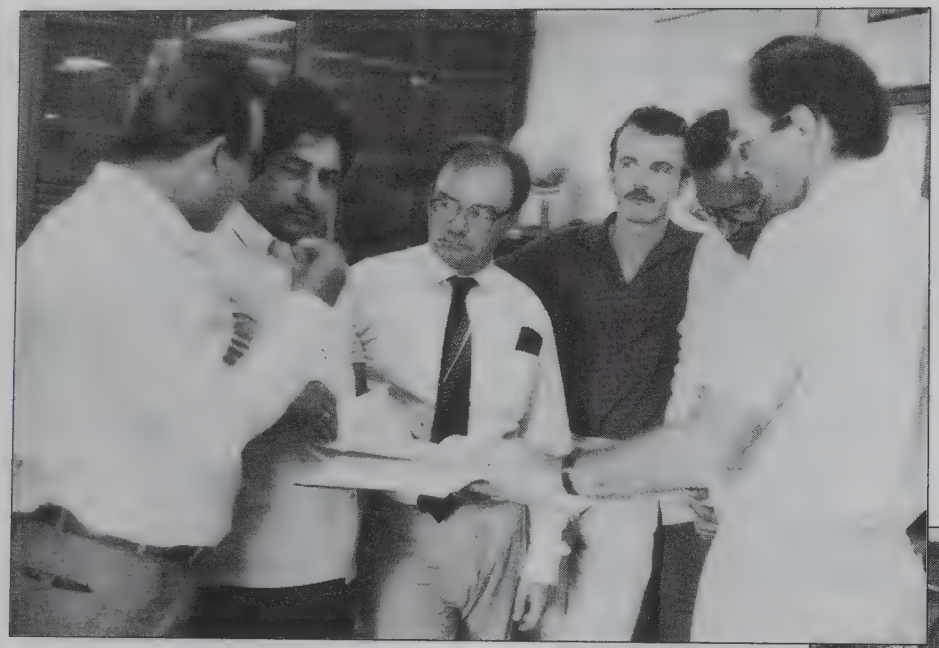
Demographic and health indicators: Matlab MCH-FP area compared with the goals set by the Fourth 5-Year Plan (1990-95)

Demographic indicator	Situation in 1990	Goal for 1995/96	Matlab MCH-FP in 1989/90
Crude Birth Rate*	34.5	30.1	29.0
Crude Death Rate*	13.6	11.9	8.0
Total Fertility Rate #	4.3	3.4	3.7
Contraceptive Prevalence Rate +	40.0	50.0	60.0
Neonatal Mortality Rate**	80.0	65.0	43.0
Infant Mortality Rate**	110.0	80.0	70.0
Maternal Mortality Rate**	5.7	4.5	4.6
Tetanus Toxoid Coverage Rate ##	40.0	80.0	82.0
Measles Vaccine Coverage Rate++	34.0	80.0	84.0

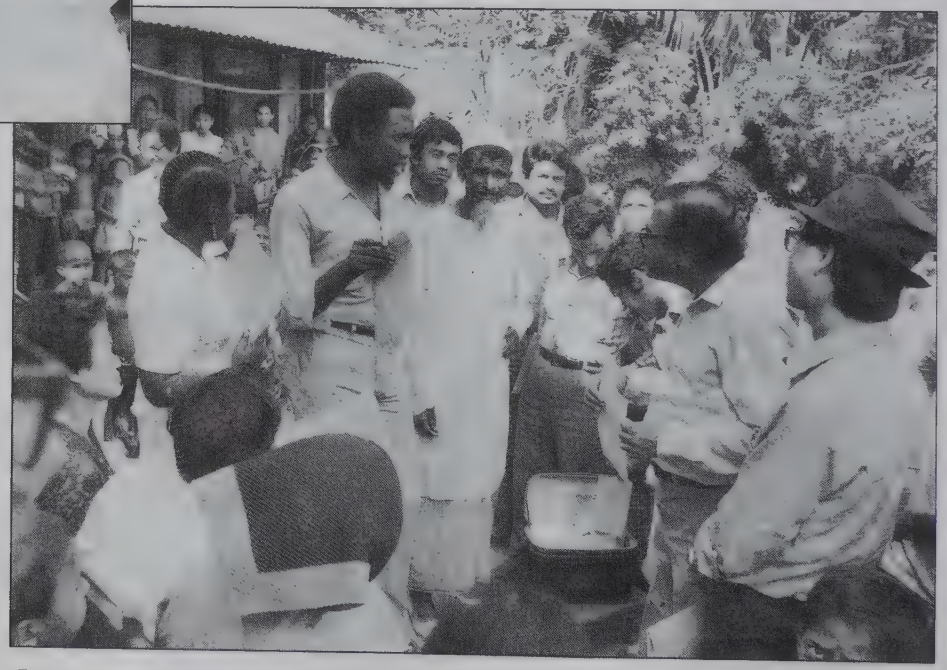
** : per 1,000 population # : children per woman + : per 100 eligible couples ** : per 1,000 live-births*
: per 100 women of child-bearing age ++ : per 100 children aged 9 to 24 months

CONTINUED...

Conclusions



Representatives from bilateral and international donor agencies keep a close look at the progress of the Matlab Project. Shown above is a visit of the French Ambassador to the DSS office (from left to right: Dr Yunus, Mr Islam, HE Mr Stanislas Filliol, Mr Dominique Chatton, the Chandpur Civil Surgeon and Vincent Fauveau).



Participants from one of several international courses organised by the ICDDR,B are taken to Matlab and shown the work done in villages.

evidence and influenced the Government of Bangladesh to modify its Family Planning and Health policy;

2) areas in which the Matlab experience has led to recommendations, but the government programme has not modified its policy accordingly;

3) areas in which Matlab has failed to gather enough data or to conduct proper analyses; and

4) areas that are considered important but have not been examined in Matlab. The last two categories also represent issues for further research.

These four categories of issues are now addressed in detail:

2. 1. Areas in which the Matlab experience has provided clear evidence and influenced the Government of Bangladesh to modify its Family Planning and Health policy:

Workers-population ratio: (see Chs. 6 and 22)

The government's family planning programme had one worker per 6,000 population; the Matlab project had one per 1,200. It was decided in 1986 that, in consideration of costs and benefits, the ratio of government family planning workers per population would be changed to one per 3,000, which meant recruiting more than 12,000 new Family Welfare Assistants (FWAs), training them and placing them in peripheral postings (about five FWAs per union). The ICDDR,B, through the MCH-FP Extension Project, was put in charge of the recruitment and training of these new FWAs.

Service Record Keeping System: (see Chs. 6 and 22) A slightly modified version of the Matlab Service Record Books has been distributed to each FWA in the government's family planning programme.

Supervision-monitoring: (see Chs. 6 and 22) The roles, tasks and supervision cycles of the female Family Welfare Visitors in the government's family planning programme are those which were field tested, reviewed, and evaluated in Matlab.

The strategy of supply: (see Chs. 6 and 22) The importance of uninterrupted family planning supplies and the methods to ensure their smooth delivery were established in Matlab.

Choice of contraceptives: (see Chs. 6 and 22) The need to provide as broad a choice of contraceptives as possible, to offer the possibility of switching methods and to ensure continuity of use, was derived from the Matlab experience (a broad choice is not yet offered to clients in all parts of the country, mostly due to lack of appropriate supplies).

Injectables: (see Ch. 6) Injectable hormonal contraception, by far the most popular method in Matlab, has become a regular part of the government's family planning programme, although it is not yet delivered at the doorstep as it is in Matlab.

Outreach immunization services: (see Ch. 6) The delivery of immunization services at the doorstep was tested in Matlab and then implemented (in a slightly modified form - the satellite clinics) in the National Expanded Programme on Immunization (EPI).

Measles vaccination: (see Ch. 11) The magnitude of the decrease in childhood mortality in rural Bangladesh as a result of measles vaccination was established by research conducted in Matlab. These findings influenced and supported the adoption of a widespread measles vaccination programme by the National EPI.

Tetanus toxoid immunization: (see Ch. 8) The magnitude of the effect of tetanus toxoid immunization on overall infant/neonatal mortality, as well as the various schedules and target populations for the immunization were evaluated in

CONTINUED...

Matlab. The recommendations arising from these studies were then adopted by the National EPI.

Oral rehydration therapy (ORT): (see Ch. 9) Some of the first trials of ORT were conducted in Matlab, leading to the development of the National Programme for Control of Diarrhoeal Diseases.

Non-effectiveness of injectable cholera vaccine (see Chs. 3 and 9) Studies done in Matlab served as a basis to recommend the discontinuation of the former government policy of using injectable cholera vaccines. In spite of several vaccine trials performed in Matlab, however, the search for an ideal (long-term, effective and affordable) cholera vaccine continues.

Community-based management of Acute Lower Respiratory Infections (ALRI): (see Ch. 10) The Matlab trials of ALRI management have served as a basis for the establishment of the National ARI Programme. Although the drug used in the first Matlab community-based trial was injectable penicillin, the National ARI Programme later requested that Matlab investigators evaluate the same approach using oral co-trimoxazole.

2.2. Areas in which the Matlab experience has led to recommendations but the government programme has not modified its policy accordingly:

CONTINUED...

Conclusions

Growth monitoring: (see Ch. 12) Research done in Matlab has led to a recommendation to use the mid-upper-arm circumference as a predictor of the risk of dying from malnutrition, rather than the traditional growth monitoring based on weight for age.

Rice-based oral rehydration solution (rice-ORS): (see Ch. 9) Research done (partly) in Matlab and in neighbouring Chandpur has outlined some of the benefits of rice-ORS compared to glucose-ORS.

Role of nurse-midwives in the community: (see Chs. 7 and 18) The Matlab Maternity Care Project has led to the recommendation of posting nurse-midwives in villages, provided they are assisted by an effective referral system.

Reproductive tract infections: (see Ch. 7) Diagnostic and therapeutic guidelines for gynaecologic infections have been established in the Matlab MCH-FP clinics and recommended for wider use.

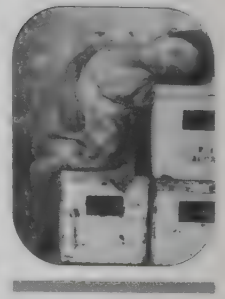
Measles immunization before nine months: (see Ch. 11) The analysis of the age distribution of measles cases and measles deaths in Matlab has led to the recommendation that the National EPI immunize children before the age of nine months (provided a safe and effective vaccine is found, and successfully field-tested).

"Verbal autopsy": (see Ch. 5) "Verbal autopsy", largely tested in Matlab as a tool to assess the cause of death, has been recommended for use throughout the country, to study the epidemiology of common diseases, assess priorities, and monitor and evaluate programmes.

Gender preferences: (see Chs. 16 and 19) Research in Matlab has established the magnitude, causes and effects of gender preference in traditional rural societies. It has been shown in Matlab that the home delivery of health services has the potential to reduce gender differentials in the coverage of health services.

2. 3. Areas that have been addressed in Matlab but in which the Matlab project has failed to gather enough data or to conduct convincing analyses (These areas are, therefore, avenues for further research):

Nutrition rehabilitation units: (see Ch. 12) Methodological difficulties have impeded the proper analysis of the effect on mortality of nutrition rehabilitation either in the central clinic or in peripheral subcentre units.



Antenatal care and screening: (see Ch. 7) The problem with studies on antenatal care and screening for high-risk pregnancies is the absence of proper interventions to reduce the high risks once detected. Apart from birth spacing, no successful preventive interventions have been found to reduce high-risk pregnancy.

Certain other maternal care interventions: (see Ch. 7) Training of traditional birth attendants (TBAs), distribution of safe-delivery kits to pregnant women, and supplementation of pregnant women with iron-folic-acid, all suffer (for their evaluation) from lack of data on the actual use of these services.

Effectiveness of the referral system for obstetric problems: (see Ch. 7) The conditions for an effective referral system have not been properly determined and field-tested.

Establishment of a minimum package of obstetrical interventions at district or union level: (see Ch. 7) What should the scope of this minimum package be and how should it be operated?

Women's morbidity: (see Ch. 7) Data on various causes of female morbidity collected in the Matlab MCH-FP project have not been analysed, and except for reproductive tract infections, detailed therapeutic guidelines have not been proposed and tested. Anaemia and its prevention are among the priorities.

Management of diarrhoea in the community: (see Ch. 9) In spite of an almost universal knowledge of ORT, people's understanding of diarrhoeal diseases and related changes in behaviour regarding rehydration and nutritional management of diarrhoea need to be explored further.

Health effects of long-term contraceptive use: (see Ch. 6) Fifteen years after the introduction of contraceptives in Matlab, lack of specific indicators and clear definitions have impeded the investigation of their effects on the health of the women who use them.

Vitamin A capsules: (see Ch. 12) In spite of a large-scale vitamin A capsule distribution trial, longitudinal data have not been analysed to determine its impact on mortality.

Costs and cost-effectiveness of MCH-FP services: (see Chs. 20 and 21) In view of the current scarcity of resources, more specialized research is needed to refine the assessment of costs and the cost-effectiveness of family planning and maternal and child health services and to allow informed choices in service delivery.

2. 4. Areas that are important to consider but have not been addressed scientifically in Matlab (These areas are also potential issues for future research):

Injuries and their prevention: Reliable data on deaths due to injuries are easy to obtain through the "verbal autopsy" procedure. More difficult to appreciate is the role of non-fatal injuries and that of sequellae of injuries. Epidemiological data indicate that injuries accounted for 28 per cent of all deaths among children aged 1 to 4 years (1986-89), with drowning being the predominant cause; and 13 per cent of all adult female deaths (1976-89), with intentional injuries (suicide, homicide) the predominant causes. With the decrease of infectious and other causes of death pertaining to MCH-FP interventions, the role of injuries tends to increase relatively. Investigations of risk factors and preventive interventions are needed.

CONTINUED...

Conclusions

Essential drug lists for MCH-FP: Basic drugs are used daily in the Matlab MCH-FP Project, but no systematic research has been proposed to establish and evaluate minimum supply lists for various levels (community health workers, subcentres, central clinic), nor to study drug supply systems.

Drinking water: The health effects of drinking water from tube-wells and, more generally, from a range of different sources have not been systematically evaluated.

Use of maps for Geographical Information Systems: One of the foundations of epidemiology, the study of places or geographical distribution of diseases, has long been neglected in Matlab. The development of new technologies (satellite photographs, computerized geographical data processing) should allow significant progress not only in the study of transmission patterns of communicable diseases (cholera, dysentery, measles) but also in demography (migrations, mortality, fertility).

Prevention of dysenteric diarrhoea: The leading role of dysentery in diarrhoeal morbidity and mortality has been established in Matlab, but preventive interventions have not been implemented and evaluated in a rural environment. Nor have specific interventions based on changes in personal or familial hygienic behaviour.

Role of trace elements in nutrition, growth, and immunity: The longitudinal nutrition and morbidity surveillance, associated with a considerable laboratory capacity, should allow more research in the role of trace elements, such as iron, zinc, and selenium, in nutrition, growth and immunity.

Integration of traditional practitioners: Although occasional censuses of traditional practitioners operating in Matlab have been performed (Fauveau, *et al.* 1991), no attempts have been made to contact them systematically or to collaborate with them.

CONTINUED...

Conclusions

Immunization: The effectiveness of other vaccines, such as pertussis, polio, BCG, haemophilus, and streptococcus, have never been investigated in Matlab. The field-testing of a measles vaccine that can be administered before the age of nine months must be planned.

Role of economic development in health improvement: A remarkable feature of the Matlab project during 1975-1990 has been the exclusive focus on health and family planning interventions. This has provided the conditions for a unique opportunity to study the demographic and health effects of a programme without particular economic, agricultural, income-generating, or educative input (the only exception being the employment opportunities provided to female community health workers discussed in Chapter 17).

It is acknowledged that the overall socio-economic development in the Matlab area during the 15 years covered by this review could have played a substantial role in improving the quality of life and reducing mortality.

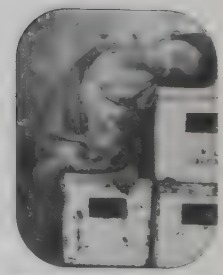
However, all economic observers admit that this overall development has been very slow and, in any case, counter-balanced by the growth of population. In addition, whatever progress has been achieved, it has almost certainly affected the Matlab intervention and comparison area equally, and has not confounded the comparison.

After a long period of health input, there is now a strong case for implementing other developmental programmes and evaluating their effects on demographic and health patterns.

The expertise for such input (rural credit schemes, improvement of agricultural practices, income generation, women's empowerment, adult education) may not exist in the ICDDR,B, but is certainly available in Bangladesh in other institutions.

The introduction of these new issues into the Matlab area and ICDDR,B's research agenda will probably raise new problems and perhaps some conflicts, but it is a logical next step and is in accordance with the current trends of community-based development.

It seems that after a long period of exclusive biomedical and demographic attention, Matlab is now ready for such a broadening of the scope of its activities.



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INDEX OF MATLAB INVESTIGATORS

SHORT BIOGRAPHIES OF SCIENTISTS HAVING WORKED IN MOTHER AND CHILD HEALTH AND/OR FAMILY PLANNING IN MATLAB BETWEEN 1975 AND 1990

Criteria for inclusion: having conducted (or participated in) at least one study in Matlab between 1975 and 1990 and published at least one paper as first author (exception for associate directors and directors).

(Note : Given the number and the mobility of the scientists who have worked in Matlab, it has been extremely difficult to compile this section. Readers are asked to accept the editor's apologies for any errors, omissions, or failures to have reported the most recent information.)

Akbar, Jalaluddin, MA, population scientist, from Bangladesh, was associated with the initiation, operation and related research of the Matlab Record Keeping System from 1982 to 1990. Now at the Michigan School of Public Health, USA (PhD programme).

Aziz, KM Ashraful, PhD, sociologist and anthropologist, from Bangladesh, was the Head of Matlab Field Surveillance Branch from 1965 to 1977. Has conducted epidemiological and anthropological research in Matlab (1974-1980), Teknaf (1981-1982), Mirzapur (1983-1987), and again in Matlab from 1990 until now. Now Senior Scientist, Community Health Division, ICDDR, B.

Bairagi, Radheshyam, DSc, demographer/ statistician, from Bangladesh, has been conducting studies on anthropometric indicators of mortality; age misstatement; malnutrition and diarrhoea; efforts of gender preference on contraceptive use, fertility and mortality; contraceptive use dynamics; and demographic estimation techniques, from Matlab data since 1978. He is currently with the Population Science & Extension Division, ICDDR, B.

Balk, Deborah, PhD, social scientist (demography, public policy), from the USA, conducted the first cost-effectiveness analysis of the Matlab MCH-FP Project (1978-85) from to 1988 (in residence from 1985 to 1987). Now at the population Studies Center, University of Michigan, USA.

Baqui, Abdullah Hel, MBBS, MPH, DrPH, a Bangladeshi epidemiologist, was associated with a longitudinal study on diarrhoea and growth in Matlab (1978-80), served as the MCH-FP physician of the Matlab Station (1980), was in-charge of Matlab Clinical Services (1981-84), conducted epiducted epidemiological studies on diarrhoea (1982) and persistent diarrhoea (1987-90). Currently, he is the Head of Research & Evaluation at the Urban Health Extension Project (formerly, Urban Volunteer Program) of ICDDR, B and an Associate of the Department of International Health at the Johns Hopkins University, USA.

Becker, Stan, PhD, Demographer, from USA at ICDDR, B from 1978 to 1980, has conducted research on reproductive health and on seasonality of demographic events in Matlab and contributed to the longitudinal study on diarrhoea and growth. Now Associate Professor, Department of Population Dynamics, Johns Hopkins University School of Hygiene and Public Health, Baltimore, MD, USA.

Bhatia, Shushum, MD, MPH, from India, was MCH-FP Physician at the start of the Matlab FPHSP from 1977 till 1981, has conducted several studies of reproductive health and contraceptive use, and a study of neonatal and post-neonatal mortality in Matlab in 1985. Now with the Department of Population Dynamics, the Johns Hopkins University School of Hygiene and Public Health, USA.

Bhuiya, Abbas, PhD, population scientist, from Bangladesh, has been involved in demographic studies in Matlab since 1980. Contributions include studies on socio-economic determinants of health and mortality. Currently with the Population Studies Centre, ICDDR, B.

Black, Robert E., MPH, epidemiologist, from USA, has conducted research in Matlab from 1977 to 1979 on the epidemiology of diarrhoeal diseases (E. coli, rotavirus, cholera), on the implementation of community-based oral rehydration therapy, on the effect of diarrhoea on lactose absorption, on the incidence of paralytic poliomyelitis, on the efficacy of maternal immunization on neonatal tetanus, and on reactogenicity and immunogenicity of the Wellcome cholera toxoid. Now Professor and Chairman, Department of International Health, the Johns Hopkins University School of Hygiene and Public Health, Baltimore, MD, USA.

Boyce, John M., MD, infectious diseases clinician, from USA, has conducted a study on transmission patterns of Shigella infections in Matlab in 1979. Now at the miriam Hospital Division of Infectious Diseases, and Brown University School of Medicine, Rhode Island, USA.

Briend, Andre, MD, nutritional epidemiologist, from France, was on secondment from the Institute Francais de Recherche Scientifique pour le Developement en Cooperation (ORSTOM) from 1984 to 1989, was Associate Director, ICDDR, B and Head of Community Health Division in 1989, has conducted research on the relationship between anthropometry and mortality, breast feeding and child survival, nutritional interventions including nutrition rehabilitation, epidemiology of vitamin A, impact of vitamin A supplementation on morbidity and mortality, and nutrition surveillance. Now with Institute National pour la Science et la Recherche Medicale (INSERM), Paris.

Briscoe, John, PhD, environmental engineer, from South Africa, conducted studies of determinants of water use, and the effects of water use on diarrhoea in Matlab, 1976-1978. Currently Chief, Water and Sanitatition Division, World Bank, Washington, USA.

Brown, Kenneth H., MD,. pediatrician and nutritionist, from USA, was associated with longitudinal studies of diarrhoea, morbidity and nutrition in Matlab, 1977-79, and has conducted several nutritional studies. Now Professor, Department of Nutrition, and Director, Program in International Nutrition, University of California-Davis, USA.

Chakraborty, Jyostnamoy, post-graduate Diploma in Food Science and Nutrition, from Bangladesh, joined Matlab in 1963, Manager, Health Services since 1978, has been associated with virtually all community-based studies carried out in Matlab from 1968 till now. Now with the Community Health Division, ICDDR, B.

Chen, Lincoln C., MPH, epidemiologist, from USA, has conducted epidemiological studies in Matlab from 1970 to 1971 and again from 1976 to 1980, on nutritional anthropometry and the risk of death, on the relation diarrhoea-malnutrition, on sex differentials, causes of death, and maternal mortality. Now Professor and Chairman, Department of Population and International Health, Harvard University School of Public Health, USA.

Chowdhury, Al., BA, D. Stat., biostatistician, from Bangladesh, was associated with the Matlab Demographic Surveillance System from 1966 to 1985, and then with the Matlab MCH-FP Project from 1986 till today, analysed several studies in reproductive epidemiology. Now with the Community Health Division, ICDDR, B.

Chowdhury, AKMA., ScD, demographer, from Bangladesh, was involved in the Matlab Demographic Surveillance System, has conducted several demographic studies (1978-85), a study of infant mortality in a declining fertility population (1984) and a study on maternal nutrition. Now retired.

Chowdhury, Mridul K., PhD, biostatistician, from Bangladesh, was involved in the Matlab Demographic Surveillance System from 1978 to 1990. While serving as the Head of Statistics for overall management, supervision, quality control and regular monitoring (in the form of annual demographic reports) of Matlab Demographic Surveillance System data. Presently he is with the Population Studies Centre, ICDDR, B and has conducted several demographic and epidemiologic studies using Matlab data from 1978 till today.

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Ciznar, Ivan, PhD, immunologist, from Slovakia, was Associate Director and Head, Laboratory Science Division from 1983 to 1988, Now with the Research Institute of Preventive Medicine, Bratislava.

Claquin, Pierre, MD, from France, was associated with the Matlab FPHSP Project from 1980 to 1982, and with the start of the MCH-FP Extension Programme in 1982-83, has conducted a study on cost-effectiveness in diarrhoeal disease control. Now with the Aga Khan Foundation in Geneva.

Clemens, John D., MD, epidemiologist, from USA, has conducted epidemiological research (diarrhoea, cholera, dysentery, measles, breast feeding) in Matlab from 1983, was principal investigator of the Oral Cholera Vaccine Trial of 1985-88. Now with the National Institutes of Health, Bethesda, MD, USA.

Craig, Marian, geographer, from UK, has conducted a study in Matlab on transmission of cholera in 1983.

Curlin, George T. MD, epidemiologist, from USA, has conducted studies on cholera, environment, and demographic impact of the 1971 war of independence during 1974-77, was Head of the Epidemiology Division in 1975-77. Now with the National Institutes of Health, Bethesda, MD, USA.

de Francisco, Andres, MD, MSc, epidemiologist, from Colombia, principal investigator of the Matlab MCH-FP Project from November 1990 till

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today, has initiated studies on measles, neonatal tetanus, acute respiratory infections, vitamin A, birth weight.

D' Souza, Stan, PhD, demographer, from India, was Associate Director, ICDDR, B and Head, Community Health Division from 1979 to 1984, was in Charge of the Matlab Demographic Surveillance System, conducted several demographic studies and studies on socio-economic determinants of health, disease, and mortality. Now with the United Nations Department of Economic and Social Development in Zaire.

Duza, Badrud, PhD, social scientist from Bangladesh, was Associate Director, ICDDR, B and head, Population Science & Extension Division, from 1986 to 1988, conducted a qualitative study on fertility and mortality transition in Matlab (with Moni Nag) in 1986-87. Now with the World Bank in Washington, USA.

Eeckels, Roger, MD, DTMH, from Belgium, was ICDDR. B's Director from 1985 till 1989, supported several clinical and community-based studies in Matlab. Now Professor of the Department of Pediatrics, University of Leuven, Belgium.

Faiz, Khodezatul K., PhD, economist, from Bangladesh, consultant to the MCH-FP Extension Project from 1987 till 1989, has participated in the Matlab FOHSO cost-effectiveness analysis. Now program officer, Overseas Development Agency Health and Population NGO Project, Dhaka, Bangladesh.

Faruque, Ahmed, MBBS, MPH, epidemiologist, from Bangladesh, was associated with the Matlab Cholera Vaccine Trial of 1985-88 with J. Clemens, has conducted an epidemiological study in 1987-88 on the risk factors for Shigella infection in the community. Now with the Department of Epidemiology, the Johns Hopkins University School of Hygiene and Public Health, USA (PhD programme).

Faruque, ASG, MBBS, MPH, epidemiologist, from Bangladesh, was associated with the Matlab FPHSP from 1976 to 1979, involved in several studies on reproductive health, then posted in the neighbouring Chandpur Project and involved in studies on diarrhoea. Now with the Clinical Sciences Division, ICDDR, B.

Fauveau, Vincent, MD, MPH, from France, joined the Matlab MCH-FP project in September 1985, project director from 1987 till June 1990, was associated in research on maternal mortality and mortality, impact of immunizations (with M. Koenig), has implemented various MCH interventions and conducted research on their mortality impact using an improved assessment of causes of death. Now country representative for UNFPA in Cambodia.

Glass, Roger I., MD, PhD, epidemiologist, from USA, conducted epidemiologic studies on cholera and other diarrhoeal diseases from 1979 to 1983d. Now with the Center for Disease Control and Prevention, Atlanta, Georgia, USA.

Greenough, William B, III, MD, physician-scientist and educator, from USA, who established the first clinical facility at Matlab and the water communications system between Dhaka and Matlab. He participated in research on cholera and other diarrhoeal diseases and was Director of ICDDR, B from 1979 to 1985. Now a Professor of Medicine and International Health at the Johns Hopkins University in Baltimore, Maryland, USA.

Habte, Demissie, MD, pediatrician, from Ethiopia, Dean, Faculty of Medicine Addis Abbaba, from 1983 to 1989. Trustee of ICDDR, B from 1985 to 1989, Director of ICDDR, B from August 1989 till today, has supported research in Matlab in several fields.

Harris, Jeff, MD, MPH, epidemiologist, from USA, has been associated with several epidemiologic studies in Matlab from 1985 to 1987, including the Cholera Vaccine Trial. Now with the Center for Chronic Diseases Prevention, Centers for Disease Control and Prevention, Atlanta, Georgia, USA.

Hlady, Gary, MD, epidemiologist, from USA, was associated with the Matlab Maternity Care Project in 1988, has conducted a study on utilization of maternity care. Now with the Department of Health, Florida State, USA.

Horton, Susan, PhD, health economist, from UK, has conducted a study on cost effectiveness of diarrhoeal curative services.

Hussain, Mossadeque M., MBBS, PhD, epidemiologist, from Bangladesh, has conducted studies on antibiotic use and on parasitic infection in 1979-1980. Now with the Faculty of Medicine and Health Sciences, United Arab Emirates University, Al-Ain, UAE.

Huber, Douglas H., MD, MPH, epidemiologist, from USA, has directed the Matlab Contraceptive Distribution Project in 1975-78 and

done research on the health effects of contraceptive use. Now with the International Planned Parenthood Federation.

Huffman, Sandra L., PhD, nutritionist, from USA, has conducted several studies on maternal health, anthropometry, nutrition and breast feeding from 1975 to 1977. Now with the Center to Prevent Childhood Malnutrition, Bethesda, MD, USA.

Hughes, M, MD, epidemiologist, from USA, has conducted studies in 1974 on the epidemiology and transmission of cholera and shigellosis. Now Director, National Center for Infectious Diseases, Centers for Disease Control, Atlanta, Georgia, USA.

Huq, Anwarul, PhD, microbiologist, from Bangladesh, has conducted several microbiology studies in Matlab from 1968 to 1986. Now in Saudi Arabia.

Huque, Anwarul, PhD, is an environmental microbiologist, joined the ICDDR, B in 1976, has conducted a study on environmental microbiology in Matlab in 1986-90. Now with the Maryland Institute of Biotechnology, Baltimore, USA.

Huque, Bilqis Amin, PhD, environmental engineer, from Bangladesh, has conducted a study in Matlab on nutritional effect of iron in tubewell water in 1990. Now with the community Health Division, ICDDR, B.

Islam, M. Shafiqul, MA, sociologist, from Bangladesh, with ICDDR, B since 1962 till today, has conducted several studies in Matlab on socio-economic determinants of diarrhoeal diseases (1974-75), socio-cultural aspects of pre- and post-natal care (1982) and perceptions of diarrhoea and ORT (1988). Now an Associate Scientist with the Community Health Division, ICDDR, B.

Kay. Bradley, Dr. PH, microbiologist, from USA, has supervised the Matlab laboratory from 1984 to 1988, and participated in the Cholera Vaccine Trial. Now with the Center for Disease Control and Prevention, Atlanta, Georgia, USA.

Khan, Atiqur Rahman, MBBS, Dr. PH, from Bangladesh, was associated with the Matlab Contraceptive Distribution programme in 1975-77. Now with UNFPA in New York, USA.

Khan, Mehrab A., MA, data manager, from Bangladesh, was associated with the Matlab Record Keeping System from 1986 to 1991, and with several studies on reproductive health and evaluation of health interventions. Now at the Australia National University, Canberra, Australia.

Khan, MU., MBBS, PhD, MFCM, epidemiologist, from Bangladesh, has conducted many epidemiological studies on diarrhoeal diseases in Matlab between 1969 and 1985, including a longitudinal growth and development study and its relation to diseases and death in newborn children in Meheran from 1973 to 1979 and another longitudinal study on water use pattern and cholera in the entire Matlab area. Now a consultant with the Ministry of Health, Government of Saudi Arabia.

Koenig, Michael A., who holds a PhD in population Planning an International Health, is an American researcher who was on secondment to the Centre from the Population Council from 1985 to 1991. He served as Director of the MCH-

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FP Extension Project from 1986 to 1991. He was actively involved in the design and introduction of the computerized record-keeping system in Matlab, and has also undertaken extensive research on family planning and maternal and child health services and their impact upon mortality in the Matlab study area.

Koster, Frederick T., MD, immunologist, from USA, has conducted epidemiological and immunological studies on cholera, shigellosis, measles and diarrhoea in Matlab in 1975-76. Now with the University of New Mexico, USA.

Langsten, Ray, PhD, demographer, from USA, was associated with the Matlab contraceptive Distribution Programme in 1975-77, has analyzed studies on fertility, morbidity and mortality. Now a Research Associate Professor at the American University in Cairo, Egypt.

Lindenbaum, Shirley, conducted an anthropological study in Matlab Upazila on maternal education as a determinant of child morbidity and mortality in 1983. Now at the Graduate Center, City University of New York, USA.

Merson, Michael H., MD, epidemiologist, from USA, has participated in studies on rotavirus, enterotoxigenic E. coli and cholera in Matlab, from 1976 to 1978. Now Executive Director of the Global Programme on AIDS in WHO, Geneva, Switzerland.

Mita, Rezina, MSS, from Bangladesh, operations researcher, associated with several studies on

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reproductive health and women's status in Matlab with ICDDR, B. Now in Australia.

Mitra, Amal K., MBBS, DIH, MPH (US), from Bangladesh, was associated with studies on diarrhoeal diseases in Matlab from 1981 to 1985. As a Principal Investigator, conducted a community-based research on risk factors of fatal dysentery patients. Now working as an Associate Scientist with the Clinical Sciences Division, ICDDR, B.

Mosley, W. Henry, MD, MPH, population scientist, from USA, who conducted research on cholera in Matlab from 1965 to 1971 as Head of the Epidemiology Division, Pakistan-SEATO Cholera Research Laboratory, during which time he established the first Demographic Surveillance System. He returned to the Cholera Research Laboratory as Director from 1977 to 1979 to undertake the transition from the CRL to the ICDDR, B and in that period initiated the split between MCH-FP and Comparison area and the establishment of the Family Planning-Health Services Project in 1977. He is now Professor and Chairman, Department of Population Dynamics, the Johns Hopkins University School of Hygiene and Public Health, Baltimore, Maryland, USA.

Myaux, Jacques, MD, from Belgium, was associated in studies on field management of dysentery in the Matlab community from 1990. Now with the Community Health Division, ICDDR, B.

Nag, Moni, PhD, anthropologist, from India, has conducted a qualitative study on fertility and mortality transition in Matlab in 1986-87. Now with the Population Council, New York, USA.

Oberle, Mark W., MPH, epidemiologist, from USA, has conducted studies on the epidemiology and costs of cholera and other diarrhoeal diseases in Matlab in 1975-77. Now with the Washington Department of Health, and the School of Public Health, University of Washington, Seattle, USA.

Osteria, Trinidad, PhD, population scientist, from the Philippines, has analysed data from contraceptive studies in Matlab from 1977 to 1979.

Parker, Barbara, PhD, anthropologist, from USA, has conducted an anthropological study in Matlab on perceptions of acute respiratory infections in 1989. Now with USAID in Washington, USA.

Phillips, James F., PhD, demographer, from USA, was involved in the Matlab FPHSP from 1980 to 1984, has initiated the creation of the MCH-FP Extension Project in 1982-83, has conducted several demographic studies and system analyses on family planning programmes. Now Senior Associate, The Population Council, New York, USA.

Rahman, ASMM, MBBS, MSc, from Bangladesh, has conducted several studies on diarrhoeal diseases and rice-based ORS in Matlab and neighbouring Chandpur from 1966 to 1987. He was the chief physician for Matlab Hospital from 1966 to 1978, and later was the Project Head for the Chandpur Community Training Project from 1979 to 1987. Now with the Training Branch, ICDDR, B.

Rahman, Mukhlisur, PhD, social scientist, from Bangladesh, was associated with the Matlab FPHSP, has conducted several studies on neonatal tetanus, reproductive health and areal variations of contraceptive practice from 1975 to 1984. Died in 1984.

Razzaque, Abdur, MA., population scientist, from Bangladesh, has been involved in the Matlab Demographic Surveillance System from 1978 till now, has analysed data on famine, and on twinhood. Now at the Australia National University, Canberra, Australia (PhD programme).

Riley, Ann P., PhD, population scientist, from USA, has conducted studies on menarche and post-menarche growth (1989-90) and on health effects of contraceptive use (1990). Now with the Georgetown University, Washington DC.

Rob, Ubaidur, PhD, population scientist, from Bangladesh, has conducted a study on intra-uterine devices (1984) and a contraceptive survey in 1990. Now with The Population Council in Islamabad, Pakistan.

Ronsmans, Carine, MD, MPH, epidemiologist, from Belgium, has conducted studies on the distribution of health practitioners in Matlab and on bacillary dysentery in 1987-88. Now at the London School of Hygiene and Tropical Medicine, UK.

Rowland , Michael GM., MD, from the United Kingdom, formerly Associate Director, ICDDR, B and Head, Community Health Division, was Principal investigator of the Matlab MCH-FP project from 1985 to 1987. Now with the East Anglian Regional Health Authority and PHLS Communicable Disease Surveillance Centre, Cambridge, UK.

Roy, SK, MBBS, MSc. (Hum Nutr), Dip. in Biotech (UNU), PhD, nutritionist, from Bangladesh, has conducted studies on diarrhoeal diseases and mortality of hospital-discharged patients in Matlab (1975-81). Current interest in persistent diarrhoea and micronutrients. Now working as Scientist with the Clinical Sciences Division, ICDDR, B.

Ruzicka, Lado T., PhD, demographer, from Australia, was associated with the Matlab Demographic Surveillance System from September 1977 to March 1978, and was consultant to several demographic studies up to 1985. Now retired in Australia.

Ryder, R. W. PhD, microbiologic epidemiologist, from USA, has conducted aetiologic studies on diarrhoea, and nosocomial cholera in 1974-75.

Sack, David A., MD, internal medicine specialist, from USA, has conducted studies in Matlab on cholera and other diarrhoea pathogens (1977-1980), was Associate Director ICDDR, B and Head of Epidemiology, Laboratory Sciences Division from 1984 to 1987. Now Associate Professor, Department of International Health, The Johns Hopkins University School of Hygiene and Public Health, USA.

Sarder, AM., project manager, from Bangladesh, has been associated with the Matlab Demographic Surveillance System from 1964, and Manager from 1984 till today, has done a study on village health providers in 1978. Now with the Population Science & Extension Division, ICDDR, B.

Satter Thwaite, Adaline P., MD, from USA, was MCH-FP Physician in the Matlab FPHSP in 1982-83, has implemented training programmes for the field staff and introduced new family planning and maternity care interventions. Now retired.

Seaton, Brian, PhD, endocrinologist, from UK, has conducted studies on reproductive endocrinology and oral contraceptive use from 1977 to 1979. Now in London, UK.

Shahid, Nigar S., MBBS, MSc, MPH, scientist, from Bangladesh, has conducted studies on measles in Matlab 1980-81 and 1984. Now with the Community Health Division, ICDDR, B.

Shaikh, Kashem, MA, demographer, from Bangladesh, was associated with the Matlab Demographic Surveillance System from 1967 till now, responsible for data management and archives. Now with the Population Science & Extension Division, ICDDR, B.

Simmons, Georges, PhD, Social scientist, from USA, has participated in several studies, including the cost-effectiveness analysis of the Matlab FPHSP. Died in 1990, while he was Professor and Chairman, Department of Population Planning and International Health, School of Public Health, University of Michigan, Ann Arbor, USA.

Simmons, Ruth, PhD, social scientist, from USA, has participated in several evaluations of the Matlab FPHSP, and conducted a qualitative research on women's status in relation to the Matlab Family Planning Programme (1986-87). Now Associate Professor, departments of Population Planning and International Health and Public Health Planning and Administration, School of Public Health, University of Michigan, Ann Arbor, USA.

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Snyder, John D., MD, pediatrician, from USA, has conducted studies on oral rehydration therapy and poliomyelitis (1979-80). Now at the University of California, San Francisco.

Stark, Nancy, M. A., anthropologist, from USA, has conducted an anthropological field study on maternal health and use of maternity care in Matlab (1989-90). Now in Washington, DC, USA (PhD programme).

Stewart, Kathryn M., MD, MPH, epidemiologist, from USA, was associated in a study on vitamin A and diarrhoea in Matlab in 1987, was co-principal investigator of the Matlab MCH-FP Project from 1988 to 1990, has conducted studies on acute respiratory infections, nutritional impact of floods, and women's reproductive health. Now with the Institute for Resource Development, Columbia, MD, USA.

Station, Wayne, PhD, operations research scientist, from USA, was involved in the evaluation of the Matlab Contraceptive Distribution Project in 1979 and 1980. Now with University Research Corporation in Bethesda, Maryland.

Strong, Michael, PhD, population scientist, from USA, joined ICDDR,B as Head of Matlab and Teknaf Demographic Surveillance System in 1988, has participated in several demographic studies, became Associate Director, ICDDR, B and Head of Population Science and Extension Division.

Tzipori, Saul, PhD, microbiologist, from Australia, was Associate Director and Head, Laboratory

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Sciences Division, ICDDR, B from 1988 to 1990. Now with Tufts University in Boston, USA.

Van Loon, Frederick, MPH, gastro-enterologist, from the Netherlands, has participated in the Matlab Cholera Vaccine Trial and other biomedical studies from 1984 to 1989. Now at the Johns Hopkins University School of Hygiene and Public Health, Baltimore, USA (PhD programme).

Wasserheit, Judy N., MPH, epidemiologist, from USA, has conducted a biomedical study on reproductive tract infections in Matlab in 1984-86. Now Director, Sexually Transmitted Diseases Programme, Center for Disease Control and Prevention, Atlanta, USA.

Wojtyniak, Bogdan, biostatistician, from Poland, was Head of the Matlab and Teknaf Demographic Surveillance System from 1984 to 1988, was associated with several demographic and health services studies. Now at the National Institute of Hygiene, Warsaw, Poland.

Yunus, Mohammed, MBBS, MSc, scientist, from Bangladesh, was medical officer in Matlab from 1968, was associated with many studies on diarrhoeal diseases in Matlab, and conducted the ORT field trial in 1979-80. He was Head of Matlab station from 1980 to 83, and coordinator of the Matlab station and MCH-FP Extension Project from 1983 to 1985, and is coordinator of Matlab Health and Research Centre from 1985 till now. He is with the Community Health Division, ICDDR, B.

Zaman, K., MBBS, MPH, from Bangladesh, Assistant Scientist and Senior medical officer in Matlab from 1979 till today, was involved in several hospital-based and community-based studies on diarrhoeal diseases, including one on hypokalaemia in 1982. Now with the Community Health Division, ICDDR, B.

Zeitlyn, Sushila, PhD, anthropologist, from UK, has conducted an anthropological study in Chandpur, Matlab, on health seeking behavior, linking maternal education and child care. Now working with ODA in Malawi.

Zimicki, Susan, epidemiologist, from USA, was involved in the Matlab ORT field trial in 1979-80 and in the improvement of the assessment of causes of death. Now with the Annenberg School of Communication, University of Pennsylvania, Philadelphia, USA.

Additional list of scientists who have published works based on analyses of Matlab data:

Caldwell, John, demographer, from Australia

DeGraaff, Deborah S., population scientist, from USA

Ford, Kathleen, reproductive epidemiologist, from USA

Foster, Andrew, demographer & economist, from USA

Maloney, Clarence, anthropologist, from USA

Mostafa, Golam, demographer, from Bangladesh

Menken, Jane, demographer & sociologist, from USA

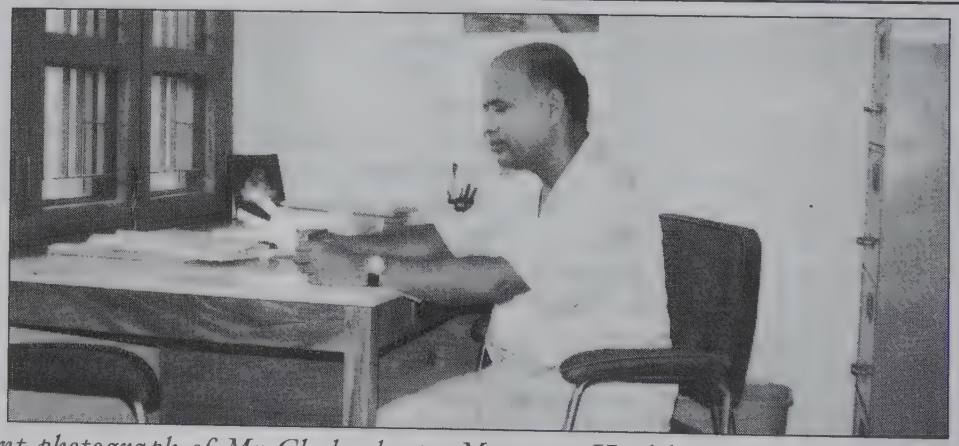
Muhuri, Pradip K, demographer, from Bangladesh

Rahman, Mizanur, demographer, from Bangladesh

Pebley, Ann, reproductive epidemiologist, from USA

Stoeckel, John, demographer, from USA

Seenson, Ingrid, reproductive epidemiologist, from USA



A recent photograph of Mr Chakraborty, Manager Health Services, Matlab MCH-FP Project, one of the very first Matlab staff members. He appears (second from left) again on the facing page, in a photograph taken years ago, during a visit of project managers to the villages. He is flanked by Dr. Yunus (left), Mr. Sarder (right) and community leaders.

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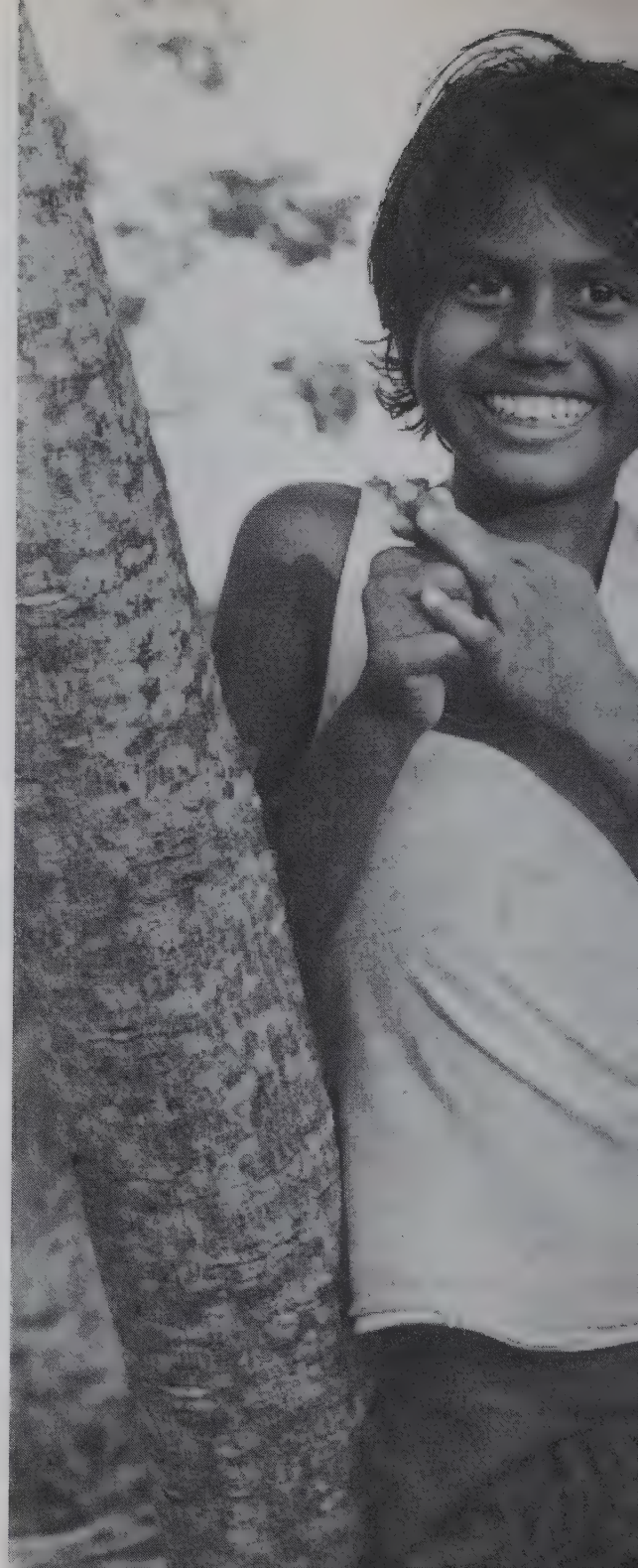

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